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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:
ELECTRO-PLATERS REVIEW.

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A MONTHLY JOURNAL RELATING TO THE METAL AND PLATING TRADES

Contents, Page 490 Directories, Page 69 Want Ads, Page 79 Index to Advertisements, Page 89

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Vol. 15. NEW YORK, NOVEMBER, 1917. No. 11.

THE ARMY OR MILITARY BRONZE FINISH

Valuable Directions for Producing This Now Popular Color.

Written for The Metal Industry by Charles H. Proctor.

The calling of thousands of men in the United States to the colors has necessitated the clothing of these men in the Khaki uniforms now used by the army. The layman as a rule does not realize what this tremendous task means and the amount of labor involved in clothing such a vast army. These uniforms bear the insignia of the United States in the form of buttons made from copper and bearing the initials "U. S. A." In days gone by one or two New England firms practically controlled the manufacture of army buttons and monopolized the business because the methods used for finishing them were practically unknown to other button manufacturers.

Not only are military buttons being made by the millions, but millions of other insignia of a similar form which are also to be used by the forces of the United States army for recognition purposes are being manufactured. All of these various articles are being finished in military bronze. Many concerns who have taken up the manufacture of these products have been in a quandary because they have been unable to meet specifications in finish that would pass the inspection of the army officials. Fortunately many firms have been able to imitate the finish successfully by part plating, part coloring and finally enameling with pigment enamels to produce a true resemblance to the standard military finish.

EXAMPLES OF METAL INSIGNIA PRODUCED IN WHAT IS KNOWN AS MILITARY BRONZE FINISH.

It is my intention to give in detail the methods used in producing the original finish and methods in vogue to produce the imitation chemical finish by the pigment method which has proven very successful.

Army buttons are made from solid copper with a brass screw back fastener. The finish used on these buttons is a rich dark brown tone without a lustre. The navy buttons are made from brass and finished in ormolu gold by a combination of mercury or fire gilding and electro-gilding and the finish must be durable.

In producing the original military bronze finish, unless the button and its fastener are made entirely from copper, it is necessary to copper-plate them. This is usually accomplished by mechanical plating in a vertical barrel or mechanical plating tank. The solution used for this purpose consists of the following ingredients:

Water	1 gallon
Sodium cyanide....	6½ ounces
Copper cyanide....	5 ounces
Soda ash..........	4 ounces
Hyposulphite of soda	¼ ounce

For this solution use a voltage of from 6 to 8. After plating the buttons should be washed and dried. A saturated solution of copper nitrate should now be prepared by dissolving all the copper nitrate possible in hot water at a temperature of 180 degrees. The buttons should then be placed in a tumbling barrel, revolved at from 4 to 6 revolutions per minute and a sufficient amount of the copper nitrate solution applied so the buttons will be covered uniformly by rotation. An excess of the copper nitrate should be avoided or the buttons will come out patchy in the final finish. After tumbling for a few minutes the buttons will have a dark stained appearance.

Remove the buttons and place upon sieve pans made from iron wire mesh, then heat the buttons to a temperature of seven or eight hundred degrees in a closed retort with provisions for carrying off the smoke fumes. After the smoke fumes have all been eliminated the heating operation is finished and as a result the copper nitrate is converted into brownish black oxide of copper, which proves to be a permanent finish. If the buttons are to be lacquered then a matt finish lacquer should be used so no added lustre is given to the buttons. However, if a semi-lustre is desired then the

buttons may be tumbled very slowly in connection with very small sections of kid leather in a vertical tumbling barrel.

PIGMENT METHOD

The pigment method is carried out as follows: If the buttons or ornaments are of solid copper then they should be cleansed with the usual hot cleaning solutions, washed and acid dipped in an acid mixture composed of the following:

Nitric acid 38°	1 gallon
Sulphuric acid	½ gallon
Water	1 pint
Muriatic acid	1 ounce

After acid dipping wash thoroughly in water and then immerse in a cyanide dip.

Water	1 gallon
Sodium cyanide	4 ounces

The cyanide dip will remove any acid stain, then rewash in water and color brown by immersing in a cold solution composed of

Water	1 gallon
Polysulphide	½ ounce

Immerse the articles until a dark brown finish is produced, then wash in water and dry out thoroughly.

The next operation is to apply the pigment enamel. While it is not absolutely necessary to lacquer the buttons it will be found that the enamel will cling better and the backs of the buttons will be protected from tarnishing. It is, however, only necessary to apply the enamel to the front or exposed parts of the buttons. The lacquer for this purpose should consist of 1 part of white French varnish and 2 to 3 parts of equal proportions of amyl acetate and fusel oil mixed together. The lacquer can be applied to the buttons by dipping, then drain thoroughly and dry out as usual in the lacquer oven. When the buttons are cold place them upon trays made from iron wire mesh about 12 by 18 inches. The buttons or ornaments should be placed with the face upwards on the sieve frames and the enamel sprayed upon them.

The best enamel for this purpose is produced by a well known lacquer concern and is termed No. 101 New and is only used with a thinner. This enamel gives a good imitation of the chemical finish and is accepted by the army authorities. Sometimes a slightly darker tint is required, then a combination of No. 101 and No. 201 will give the desired results. For the darker tone use three parts of No. 101 and one part of No. 201, with the necessary thinner added to produce a free flowing enamel. The enamel should be thoroughly dried at a temperature of 120 degrees Fahr.

The drying of the enamel completes the operations used for producing the military bronze finish. I do not deem it necessary to explain in detail the handling of the spraying apparatus as most platers are familiar with the method.

INCOMPETENT COMPETITION.

It has now become a well known and melancholy fact that the brass manufacturing concern which quotes the lowest prices and which cuts deeper than any one else is almost always the concern that can least afford to cut prices. This fact is due to the inefficient and badly equipped and managed plant and the manufacturing costs are actually higher than those of the real business concerns with which they are competing and which are up to date on equipment and methods for manufacturing and also know what their goods actually cost to produce and put on the market.

If the price-cutter in the brass manufacturing business hurt only himself and if, in his slow but sure system of committing suicide, he was the only one that passed out of the world of business there would be few tears shed over his demise. Unfortunately they do not commit suicide but, like a horse in a burning stable, they stand still and in their delirium they rush to their own death, killing and stamping out many of their kind before their own end comes.

When a plant of this kind goes out of business the trouble does not end there because in a great many cases they will get some other angels, such as bankers, lawyers, hardware men or real estate dealers, who know nothing about the brass business, to form a pool and buy out from the receiver the old plant and start in again on the same old unbusinesslike tactics and methods until they, too, are driven to the wall by bad business practice.

For the past two or three years all brass manufacturing concerns have been busy, and perhaps a great majority of them are making some money, though they could not possibly make money under any other than the abnormal conditions which exist now. When these abnormal conditions cease to exist and times begin to again become normal the very first thing the poorly equipped concerns will do will be to cut prices in the endeavor to hold on to the business which they have had during the present abnormal season.

The greatest thing that the Brass Manufacturers' Association can do for its members is to teach them how to figure costs, and this committee that has recently turned in its report along this line has no doubt performed a noble mission. When a manufacturer actually knows his cost of products he is much less likely to be a price-cutter than when he is not familiar with what it costs to make a certain piece of brass goods under certain conditions. Of all competition the most serious that most concerns must meet and overcome is the competition of the incompetent, and at present writing this competition bids fair to increase before it decreases.—P. W. Blair.

ZINC FOR CASTING LETTERS, FIGURES, ETC.

For many purposes, where a cheap and easily melted metal is wanted, zinc fills the bill as well as brass, but as by itself zinc does not cast well, it is usually necessary to add some other metal to break up the grain, and so produce a smoothly workable material. Copper answers very well for the purpose, and if we take 112 lb. of zinc, 5 lb. of copper, and anywhere around ½ lb. of lead, and alloy these together, we get about as good a material as can be produced. The copper is melted and alloyed with about half its weight of warm, clean zinc, and the balance of the zinc is melted separately, the copper alloy being poured into the zinc slowly and well stirred in. The alloy should be poured into bars or plates, and when cold, broken up and remelted for pouring. In the case where a white, frosted appearance was wanted on the castings, the writer made an alloy of 88 lb. zinc, 9¾ lb. copper, 1¼ lb. aluminium, and 1 lb. tin, the method of alloying being as follows: The copper was melted and the tin added, this being followed by the aluminium and enough zinc to "kill" the copper, the balance of the zinc being melted separately. After mixing and casting into plates, as mentioned above, the alloy was broken up and melted for pouring into both sand and cire perdu moulds, the castings in each case having a white color, which was held by spraying with a thin, clear and transparent lacquer, the color then keeping good for some years. Castings not protected with lacquer, however, lost their brightness in a few months, the aluminium-zinc alloy forming a grey oxide, which appeared to protect the metal from any deep decay. If carefully melted, these alloys run very sharply in sand or warm metal moulds, or in dry cire perdu moulds, but the wax in the latter should be well drained out to get the best face on the castings.

THE USE OF BRONZES IN RAILROAD TURNTABLES AND MOVABLE BRIDGES

A Paper Presented Before the American Institute of Metals, Boston, Mass., September 24-28, 1917.

By O. E. Selby, Principal Assistant Engineer, the Cleveland, Cincinnati, Chicago and St. Louis Railroad Company.

(Concluded from October)

26. Quoting again from Mr. Tinker's paper: "A bearing metal should have a low coefficient of friction, high resistance to wear and sufficient strength to resist distortion by crushing. In the case of gears and screws, a certain tensile strength and resilience are also required.

27. "The final criterion for the suitability of a metal for a specific purpose is its behavior under actual use. To determine the probable behavior of a metal submitted for such purpose, the nearer the test applied duplicates the actual conditions of service the greater our confidence in the probable outcome. It is also necessary that the test should be easily, quickly and cheaply applied, and last but most important, it should give concordant results.

28. "Friction tests are difficult to make; so also are wear tests. Resilience tests are unsatisfactory. There remain compression and tension tests which fulfill all the requirements of a test of a bearing metal except that it appears doubtful if they furnish sufficient evidence of the probable behavior of the metal in service."

29. The determination of the elastic limit in compression is one means of arriving at the desired qualities of strength, hardness and resilience. If the test could be easily, quickly and cheaply applied, and would give concordant results, it would be entirely satisfactory. But there is evidence that it cannot be cheaply applied and at the same time give concordant results. When .001 inch permanent set is taken as the elastic limit, it is necessary to work to ten-thousandths. This requires accurate and expensive machine work. One bronze maker said that recently they tried to get an accuracy of finish such that no two readings on the top and bottom faces before test would vary more than .0005 inch. It took an expert machinist six hours to scrape a test piece to this limit. This, of course, is almost prohibitive, and any smaller degree of accuracy casts doubt on the results.

30. These conditions make it desirable to find a substitute for the elastic limit in compression as a test for acceptance or rejection. Mr. B. R. Leffler thought that he had found such a substitute in the Brinell hardness, and in 1915 brought out a specification requiring only the Brinell hardness number and no other physical test except for the grade requiring tensile strength. Mr. Leffler's specifications, revised in February, 1917, have restored the elastic limit in compression (with wider limits than formerly), and the permanent set under 100,000 pounds load. Evidently, the hardness alone is not a satisfactory criterion of all the qualities desired.

31. Mr. V. Skillman says, "Regarding the Brinell test, I would consider this simply a different form of compression test. It is, I believe, a good check on the figure for permanent set, but I do not believe it gives any new data. If the permanent set is found, the Brinell hardness can be estimated closely enough for all practical purposes."

32. Mr. Tinker, in the paper referred to above, says in regard to hardness: "The latest theories of friction lead to the corollary that the harder a substance is, the greater will be its anti-friction qualities. There is some evidence of a definite relation between hardness and tensile strength. The existence of a definite relation between hardness and compressive strength is not established. As to the relation between hardness and resilience, there is a point in the hardness scale where hardness is accompanied by brittleness and resilience decreases. It thus appears that hardness may or may not indicate the presence of the qualities desired in a bearing metal. * * * It should be kept in mind that the hardness test is an indirect test. A metal is suitable for a bearing not because it is hard, but because being hard it is likely to have a low frictional resistance, or is likely to wear well, or is likely to be able to sustain a certain pressure without distortion. * * * The compression test is a direct test of one of the qualities desired and should not be discarded."

	Grade.			
	A.	B.	C.	D.
Alloy of—	Copper and tin.	Copper and tin.	Copper, tin and lead.	Copper, tin and zinc.
Tin, per cent	20 max.	17 max.	11 max.	11 max.
Lead, per cent	....	....	11 max.	....
Zinc, per cent	....	....	....	2.25 max.
Phosphorus, per cent	1.0 max.	1.0 max.	1.0 max. 0.7 min.	0.25 max.
Other elements, per cent	0.5 max.	0.5 max.	0.5 max.	0.5 max.
Elastic limit in compression, pounds per square inch	24,000 min.	18,000 min.	....	....
Permanent set under 100,000 pounds	.06 min. .10 max.	.10 min. .20 max.	....	....
Permanent set under 30,000 pounds	....	To be recorded.	To be recorded.	....
Yield point in tension, pounds per square inch	....	....	....	To be recorded.
Ultimate strength in tension, pounds per sq. in.	....	....	....	33,000 min.
Elongation in 2 inches, per cent	....	....	....	14 min.

33. Mr. Skillman says: "If a substitute were desired for the elastic limit in order that an indication would be obtained of the behavior of the bronze at more nearly working pressures than the destructive pressure of 100,000 pounds, which is required, I would suggest that a test at, say, 25,000 or 30,000 pounds be also required which should fall between certain limits. Such limits would have to be decided upon after investigating a number of compression curves which covered the load selected."

34. There is an objection to the use of too wide limits for the compression test, both for permanent set and elastic limit in that it would make it possible for founders who are not equipped for and are not accustomed to particular work, to meet the specifications with material which would not be of the desired quality.

35. Mr. Clement E. Chase suggests the elastic limit as the bottom limit, with the tin content as the top limit. This is not in the nature of a compromise, as might appear, but rather is applying the limitations where they will do the most good and removing them where the good qualities of the material would not be jeopardized. Mr. Chase argues that it is the brittleness and not the high elastic limit which is objectionable; it is the tin content which influences the brittleness, therefore, that is the thing which should be limited, and if a manufacturer is able by skill to secure a higher elastic limit with a given tin content than another, he should not be penalized.

36. There is little controversy about the test for permanent set in compression. It is direct and easily and cheaply made, and gives concordant results. The only question is as to the limits. Apparently both limits for Grade B are too high. Mr. Skillman suggests .10 to .20 inch.

CONCLUSIONS.

37. In view of the things discussed herein, the writer now suggests the substitution of the following clause for Clause 4 of the specifications published in the proceedings of the American Railway Engineering Association and to advocate the use of those specifications so modified:

4. The chemical and physical qualities shall conform with the requirements in the table on page 469.

THE SWELLING OF ZINC BASE DIE CASTINGS

A Paper Presented Before the American Institute of Metals, Boston, Mass., September 24-28, 1917, by H. M. Williams, Formerly Chemist and Engineer of Tests, National Cash Register Company, Dayton, Ohio, Now With Remington Arms U. M. C. Company, Bridgeport, Ct.

The die casting process offers many possibilities for the economic production of various small machine parts. When properly made, the castings are dense, accurate to dimension, and well finished. However, there are certain limitations to the use of die castings, which must be given consideration in addition to the cost of material and production. These limitations have to do with the physical properties of the alloy and its behavior under the different conditions to which the part will be subjected in service.

We have had the die casting process in successful operation for several years, and many new parts have gradually been added and produced in zinc base metal. Complaints were not numerous, and those received were generally passed up as due to the occasional defective casting. Our Cuban office had registered most of the complaints. They claimed that the metal swelled and caused trouble by binding. The castings causing most of the trouble were type wheels. These wheels are approximately 2 inches in diameter, and have a hub ⅞ inch in diameter, cast on one side with a recess on the other in which the hub of the next wheel runs. The dies gave .001 inch play between the hub and recess. This allowance had always been sufficient for the machine's bronze wheels, which had been in satisfactory service for many years. It seemed incredible that this alloy should swell after having been die cast and carefully inspected with gauges. At last, one of the stockkeepers, in looking over some old wheels, found that they would no longer run together, and further, that they were .005 inch larger than the die in which they had been cast. This discovery led to the following investigation:

In October, 1914, twelve type wheels were carefully measured at four points on each wheel. Six of these were sent to the Havana office, the other six were kept at the factory. Six months later the wheels were returned and remeasured. The results were as follows:

	10-6-14	4-6-15
Average size of wheels sent to Havana.	2.0075	2.0145
Average size of wheels remaining at factory	2.0077	2.0094

The wheels sent to Havana swelled .0070 inch, while those held at the factory swelled .0017 inch. This test confirmed the original complaints and showed that there must be some conditions which caused the rate of swelling in Cuba to be so much greater than in this country.

To get quick methods of determining the swelling coefficient of the various samples which we wished to test made it necessary to develop methods of producing the swell which would at least be comparable with the Cuban conditions, and if possible much more rapid. The following conditions were developed and adopted for increasing the rate of swell:

1. Heat at 98° F. in moist air.
2. Heat at 176° F. in moist air.
3. Heat at 212° F. in dry air.
4. Heat in steam at 10 lb. and 45 lb. pressure.

Comparing the first condition with actual Havana conditions, we sent five wheels, made with 1 inch brass centers, to Havana and kept five wheels at 98° F. in moist air. The wheels sent to Havana were returned after five months. They had swelled .0035 inch, while those which were heated at 98° F. in moist air swelled .0085 inch.

We consider that the effect of moist air at 176° F. is the most severe condition which will cause rapid swelling of this alloy and yet not destroy the surface of the wheels.

CAUSE OF THE SWELLING

The following lines of investigation were followed up to determine the cause of the swelling:

(1) The effect of casting temperature.

The casting temperature was varied between wide limits. This did not have any influence on the swelling.

(2) The effect of casting pressure.

The pressure was varied from 15 lb. per square inch to 200 lb. per square inch without changing the tendency to swell.

(3) The effect of annealing.

Castings were annealed at various temperatures in ovens and oil baths. They were given different rates of cooling, but this did not overcome the difficulty.

(4) The effect of oxidation.

Oxidation was prevented by nickel plating and by lacquering. This procedure did not eliminate the swell, as is shown in the following table:

Swell After 60 Days.	At Room Tem.	At 212° F.	At 176° F.
Regular metal	.0003	.0019	.0200
Regular metal (nickel plated)	.0006	.0016	.0131
Regular metal (lacquered)	.0004	.0025	.0157

(5) The effect of changes in the composition of the alloy.

The zinc base alloy which we used for our die casting work analyzed approximately as follows:

Copper	5.50%
Tin	7.50%
Aluminum	1.00%
Zinc	86.00%

The first change was a decrease of the copper content. It was found impractical to reduce the copper below 3.0 per cent. However, this reduction did not reduce the swelling tendency.

The fact that certain aluminum alloys after a time fail by cracking and warping, suggested the work on the effect of different percentages of aluminum. These alloys were made and compared with the regular metal. The approximate analyses were as follows:

	Copper.	Tin.	Aluminum.	Zinc.
Regular metal	5.5	7.5	1.0	86.0
Alloy No. 1	30	7.5	0.5	89.0
Alloy No. 2	3.0	7.5	0.25	89.25
Alloy No. 3	3.0	7.5	0.10	89.40

Swell in 60 days:	Room Temp.	At 212°F.	At 176°F.	At 98°F.	At 45 Lb. Steam. 1 H'r.
Regular metal	.0003	.0019	.0200	.0043	.1004
Alloy No. 1	.0003	.0010	.0147	.0022	.0509
Alloy No. 2	.0001	.0014	.0139	.0031	.0393
Alloy No. 3	.0003	.0002	.0003	.0001	.0020

These alloys were cast into type wheels for comparison. The above table shows the effect of our test.

Considering the test in moist atmosphere at 176° F., it will be noted that the regular metal containing 1.0 per cent aluminum swelled .0200 inch on a 2 in. diameter, while alloy No. 3, containing 0.1 per cent aluminum swelled .0003 inch. These figures are averages of readings in six different wheels at four points on each wheel. The results show conclusively that the reduction of the aluminum to 0.1 per cent will practically eliminate the swelling of these wheels.

Confirming these results, we have several wheels from the same casting as the ones used in the above tests. These were made in November, 1915. The wheels made from the regular metal and Alloys No. 1 and No. 2 have swelled to such an extent that the hubs will no longer enter the recesses, while those made from No. 3 alloy will run together as nicely as when first cast.

One point should be mentioned in connection with the regular metal. If this alloy is made, run into pigs and allowed to cool slowly as in regular foundry practice, no swelling will take place. This has been demonstrated on a .732 inch cube which has been kept in a moist atmosphere at 98° F. for over two years.

METAL INDUSTRY IN GERMANY

How the War Has Forced Metal Conservation as Shown in Articles Published in Various German Journals.

THE PRODUCTION OF ALUMINUM.

As stated in the "Echo de Mines," the production of aluminum in the year 1912, and the present capacity for producing aluminum, is represented by the following figures in the countries mentioned:

	Production in 1912 Tons.	Capacity for present production. Tons.
U. S and Canada	26,300	75,000
France	13,000	20,000
Switzerland	10,000	20,000
United Kingdom	7,500	12,000
Norway	1,500	16,000
Italy	800	7,000

The aluminum industry in the various countries mentioned is busily engaged in preparation for the time after the war, as it is supposed that a rich field will then be opened up for the use of various alloys of aluminum, and especially that aluminum will in many instances be used as a substitute for copper and tinplate. It is also stated that the use of aluminum in the United States has increased from 40,000 tons in 1914 to 50,000 tons in 1915.—"Elektrotechnische Zeitschrift," 28.6.1917.

CONVERTING ALLOYS OF ZINC AND IRON.

The results of a large number of experiments and investigations have made it clear that it is possible to convert alloys of zinc and iron into quite uniform metals, suitable for casting, by stirring into the molten iron-zinc alloys from 8 to 10 per cent. or more of either manganese free from carbon or of a high percentage ferro-manganese in the molten state, and that it is generally possible in this manner to effect the complete absorption of the manganese by the alloy in the course of a single operation. Attention must be directed to the fact that when molten ferro-manganese is employed, little or no carbon will be separated out, and that both the manganese carbides and the metallic manganese will be dissolved in the other metals forming the alloys, the influence exerted by the carbides being limited to the fact that their presence imparts a greater degree of hardness to the resulting metallic alloys than would be the case were manganese free from carbon employed—"Metall. und Erz," May, 1917.

INCREASING THE ALLOYING CAPACITY OF LEAD BY ADDING CADMIUM.

It has been found that it is possible to increase considerably the alloying capacity of lead by adding to it a suitable proportion of cadmium. If, for instance, to a quantity of pure lead there is added from 8 to 10 per cent. of cadmium and these two metals are fused together, and to the resulting alloy there is then added from 8 to 10 per cent. or slightly more, either of pure manganese or of high percentage ferro-manganese in the molten state, the whole mass being constantly stirred, there will be formed a uniform alloy which is distinguished by all the properties that are a characteristic feature of the well-known high-grade tin white metals. It is generally possible in this manner to effect the complete absorption of the manganese by the alloy in the course of a single operation. Attention must be directed to the fact that when molten ferro-manganese is employed, little or no carbon will be separated out, and that both the manganese carbides and the metallic manganese will be dissolved in the other metals forming the alloys, the influence exerted by the carbides being limited to the fact that their presence imparts a greater degree of hardness to the resulting metallic alloys than would be the case were manganese free from carbon employed.—"Metallurgie," May, 1917.

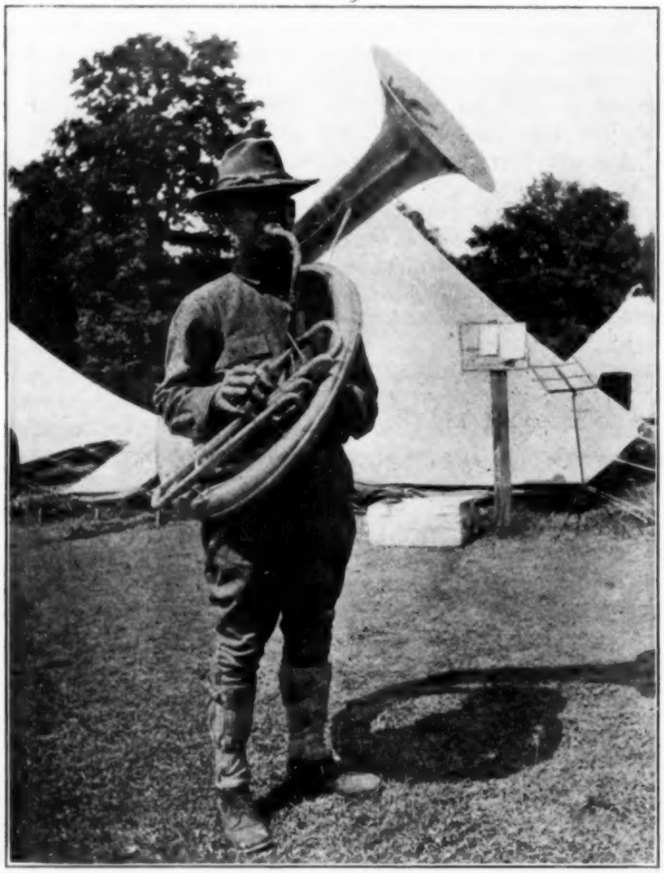
WHEN FRIEND METAL-WORKER GOES OFF TO WAR

Unique Chances for Patriotic Service for Men Used to Working Metals Other Than Iron and Steel.

Written for The Metal Industry by Felix J. Koch.

The question had come as result of the queries voiced in no end of quarters, now that universal conscription was assured, and that the prophecies of all wiseacres in present things martial were that we may have a second, and perhaps a third draft, before we are through.

Suppose—that is to say, you or I, having been chosen for Uncle Sam's legions, were asked, then, our profession, trade, craft, so on; and that we gave that of "metal-



BRASS INSTRUMENTS MUST BE PUT IN SHAPE.

worker" in reply. Narrowed down a bit more closely in this answer, we should state that our line of livelihood had to do with metal-working generally, outside the domain of matters of iron and steel. What, in the light of President Wilson's proclamation, urging that each man be employed where the most fit, would be the task to assign us?

Down at the very heart of the Midwest, at Chillicothe, Colonel Hubler, in charge of the Federalized forces guarding cantonments, has been working marvels with his troopers by applying this principle of acute specialization this long time since. Hubler's camps have been the topic of no end of newspaper and magazine articles; being held up in comparison with camps elsewhere, as typifying what can be done through specialization and using each man where most fit.

"Suppose such a man came to you for enlistment?" we put the query.

"There would be wonderful opportunity for him to render most vital patriotic service," he put it, "both in comparative safety, behind the firing line; or, if of more adventuresome nature, on the battlefront itself.

"Preferably, such a man should enlist in the ordnance department, or else in the quartermaster's department; but, if friends are along, or other causes made him volunteer with Federalized state forces, we should find abundant use for him. He might be classed as a mechanic or artificer; and while, obviously, we should give him all work with *other* metals arising, under stress of war he might be required to turn his hand to repairing metal parts of rifles; or, in camp, might be asked to lend a hand at putting into condition the camp kitchen stoves. His experience in other fields would make this the lightest kind of work and he would have a snap compared to the duties of many a man elsewhere.

ALL MANNER OF DEVICES NEED REPAIR AFTER BATTLES

"Uncle Sam, however, will not keep a good man down long along these lines, I assure you.

"Just at the moment no end of skilled metal-workers are essential for the nine regiments of engineers sent to Europe. A campaign is just now on for such men, and they may often save the day of battle just by their skill in repairing motor-trucks vital to the work. In battle, you cannot always get parts—metal—of the sort you desire, and the man who can take whatsoever sort of metal at hand and revamp it from its accustomed use in replacing some vital part of motor-trucks, is the man who's worth a gold mine to an army.

"These men, in fact, are made sergeants almost immediately, and draw far better pay than their less skillful

colleagues, who must face the rain of bullets at the actual front.

"Nor, on other hand, is this task of the metal-worker allowed to become a lazy man's job; one which makes him liable to being scoffed at on the return.

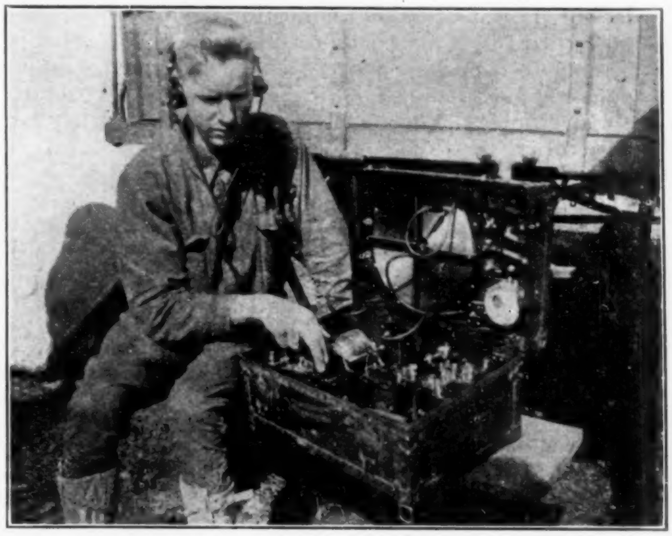
"While the actual battle is raging, this man is set to repairing railroad trains and similar media of transportation back of the firing line. A most vital field for him will be putting into working order machinery for the trams running to the trenches, and this again, with whatsoever material he can find. With the enemy about, and possibly the population hostile and seeking to conceal actual sources of supply, these men must be able to take what is to hand and adapt it to repair of whatsoever cannon shot has broken or destroyed.

"Broken parts of rifles and bayonets may become a large part of this repair work, and the men will be equipped at the outset with a portable forge and the like. After the battle, too, no end of valuable work can be done; the more that they are fresher than the men back from the firing line.

PLUMBERS PIPING TO REPAIR.

"More than this—and to the metal-worker who would enlist, but dreads the worry incidental to long separation between him and his, this news is welcome—such men can be of even greater value in the forces; but squarely here in the home-country, preparing things for the line.

"These men can become so useful to our forces that their time should not be given over to drill at all. In the nine regiments aforesaid, we understand that the men of this grade will get substantially no strictly military drill. Ordinary factory discipline will be maintained; the captain will issue orders, much as a factory foreman might; the colonel will take much the part assumed by the general superintendent in a shop. Where circumstances permit, the men will enjoy much the same hours of work in camp that they would in a factory at home. Of course, were there serious railroad wrecks, or other like unforeseen causes, it is possible that they might have to put in eighteen or twenty hours, then and there; but that is really all a 'part of the game.' So, too, right after a battle the men might be put to it, a bit, working overtime at putting in condition the thousands of bay-



ELECTRICAL INSTRUMENTS GET OUT OF ORDER.

onets brought to them; but for this there would come due recompense in extra hours of sleep.

"For a man of inventive genius, however," Hubler put it, "the task of the metal-worker with the forces offers boundless opportunity.

"Things can be done out on the battlefield and on the march, even, which would be ridiculed and laughed at in peace times at home.. Thanks to this, the 'born inventor' who believes that certain other metals could do work better than iron or steel in given places, and who has never had opportunity to make the experiment; or, making it, fears to try it out, lest he be ridiculed, can do so with full confidence of winning fullest commendation here. Automobiles, trams, locomotives especially, will permit this and the metal-worker who had place in an auto factory especially is apt to find full play for inventive genius here.

"A portable machine shop, with the man's own lathes and such like, is right at hand; everything in this brought to such high degree of perfection that, so long as stress of battle does not take it away, it is a joy just in working in it. Forge and anvils, too, on the truck, are no mean part of this moving machine shop, and it will be a vital part of the equipment of each army.

"Lord Northcliffe, it will be remembered, has been emphasizing the importance of the men behind the lines of battle in deciding the victory or defeat here; and, in the roster of these men behind the front of battle, none half-ways more important, rest assured to-day, than these."

A FORMULA FOR OXIDIZING BRONZE.

A formula for oxidizing bronze is as follows:

Water	1 gallon
Caustic soda	8 ounces
White arsenic (powdered)	4 to 6 ounces
Sodium cyanide	1 to 2 ounces

Iron anodes should be used in this solution.—C. H. P.

A FEW PATENT POINTS, WITH SOME APPLICATIONS TO ALLOY PATENTS

By Wm. J. Rich, Patent Office, Washington, D. C.

Paper Presented at Boston, Mass., Meeting of American Institute of Metals, September 24-28, 1917.

Undoubtedly the greater number of inventors, as well as the public generally, conscientiously believe that the main purpose for which patents are granted is to assist the inventors. This, however, is incorrect. The primary object of the patent system is not for that purpose. Although such result may obtain, and properly so, still it is incidental to a purpose more great, noble and patriotic. A patent is not granted for the mere purpose of enabling one man to obtain a monopoly of a certain invention for a term of years to the exclusion of others, but it is founded on a desire to benefit the entire nation.

The patent statutes are based on a provision in the Constitution of the United States. When the framers of that grand document prepared it, they had more prescience than is realized by many. Therefore we find in Section 8, enumerating the "Powers Granted to Congress" that it shall have power (among others) *"To promote the progress of science and useful arts,* by securing *for limited times,* to authors and inventors, the exclusive rights to their respective writings and discoveries." From this it will be seen that the main, in fact the *only* constitutional reason, in providing for a patent system was that broad, material idea to improve the condition of the country in general in promoting the progress of science and useful arts by permitting an inventor the exclusive right to his inventions for *a limited time,* with the understanding that after the lapse of such time, the inventions would be open to the use of any one without payment of royalty to the inventor, and the monopoly, if it may be so called, to the inventor for the term of the patent, would be sufficient to stimulate his inventive mind. How well founded was this theory can be easily seen by the results. Patents are now granted by the ten of thousands each year, amounting, up to the present time, to over one and a quarter million and the number granted annually increases each year. This may be more readily perceived by the following tables, showing the number of patents granted each decade from 1840 to 1910 and the total number granted at the end of each such decade.

Decade	Patents Granted During Decade
1841 to 1850	5,661
1851 to 1860	19,661
1861 to 1870	71,818
1871 to 1880	124,751
1881 to 1890	195,454
1891 to 1900	221,502
1901 to 1910	304,803

	Total Patents Granted
July 1, 1790 to 1840	11,422
" " " to 1850	16,938
" " " to 1860	36,599
" " " to 1870	108,417
" " " to 1880	233,168
" " " to 1890	428,622
" " " to 1900	650,124
" " " to 1910	954,967
" " " to 1916	1,176,376

This beneficent industrial result may also be observed by comparing the industrial progress of our country with that of those which have not had a patent system, at least until late years.

I made use above of the word "monopoly," but this is not strictly the case, at least in the obnoxious sense. Such an obnoxious monopoly is one that takes from the public rights which previously had existed. A patent "monopoly" does nothing of the kind. An inventor is under no obligation to disclose his invention. If new, the public was never aware of it and consequently never had any right to it. It is the inventor's option to divulge it or not, as he pleases. If he does not disclose it the public can never obtain any advantage from it.

The principle was recognized long ago in England where the Statute of Monopolies, exacted in 1623, made all monopolies illegal except those granted by parliament or those *in respect of new manufactures or inventions.* Upon this last clause is based the English system of letters patent for inventions.

From the above viewpoint, therefore, it is perfectly right and proper to offer an inventor some inducement to disclose his invention so that others may have the advantage of its use, even if they have to pay a price therefor, more, perhaps, than the cost to them if they made it themselves. But why should they not? Is not a man entitled to some remuneration for the work of his brains as well as for the work of his hands? To my mind, any outcry against the granting of a patent is based upon unsound reasoning. Such an outcry can be based on nothing more than the desire of one man to appropriate to himself the result of another's *brain,* and wherein is this any more right or honorable than a desire for the appropriation of the work of another's *hands,* such as a beautiful chair, bookcase, article of silverware or other thing made by him? I myself can see no distinction. It is only a misappropriation, no matter by what high sounding name it may be called.

Another argument in connection with the patent system is that, even without its protection, the natural born inventor would work his brain and devise things merely for the pleasure of so doing. This is a great mistake. In the first place such people are few and far between. In the second place their *inventions,* while possibly unique, are generally of such a character as serve no useful purpose. Of course there are some exceptions. The rule, however, is that the actual inventor is of a more or less practical bent of mind, possibly one who is a poor business man, but at the same time one whose idea in inventing is to make money out of it. The old idea of an inventor as a crack-brained man with wheels in his head, and ambitious to invent a perpetual motion or some equally absurd contrivance has long since passed away. Such men occasionally appear but, proportionally, they are about as rare as a two-headed calf or other freak of nature.

Patents in this country were formerly granted for a term not exceeding fourteen years. By the Statute of 1870, the term was made seventeen years. In 1874 it was provided that if a patent had been previously obtained in a foreign country the United States patent would expire at the same time as the foreign patent expired, but in no case would its term be over seventeen years. Later by statute in force beginning January 1, 1898, this limitation of term by reason of previously obtained foreign patents was removed and all patents on applications filed since that time have been granted for a term of seventeen years.

In the granting of patents no distinction is made between citizens and aliens. At one period aliens were obliged to pay a much increased fee for obtaining a patent, but this distinction has long ceased to exist.

Under the statutes, patents are granted for "arts, machines, manufactures and compositions of matter." Broadly and generally "arts" include patents for methods and processes (generally chemical, metallurgical or elec-

trical) for doing some act, achieving some result or obtaining some product; "machines" include what would naturally be understood by a technical man or a mechanic; "manufactures" include articles of manufacture, not being machines, and in condition as to be salable, such as a chair, table or even a sewing machine needle, while "composition of matter" include mixtures of ingredients or elements.

Frequently a patent is infringed. In such case the only recourse of a patentee, if he cannot, by agreement, persuade the infringer to stop, is to sue him to compel him to cease infringing and also pay such damages as the court deems proper. Some of these suits are long drawn out and very expensive to both parties.

A patentee in one court decision was likened by a judge to that celebrated character in Holy Writ, Ishmael, in that his hand was against every man and every man's against him. While his condition is possibly not quite as serious as that of the biblical character still it is true that his road is not at all smooth. Very few patents are at once accepted by rivals as being valid. Consequently in order to maintain his rights, if his invention is commercially valuable, it is necessary to bring suit against infringers. In defending this suit the opponents make use of all defenses permitted by the statutes. The most common defense is that of anticipation by older patents or publications and to determine this the defendants cause to be made elaborate and extensive searches taking days, weeks and frequently months. In such search anticipating references are occasionally discovered. Possibly the patentee may feel harshly toward the patent office in not having discovered these references; but if they only understood the true conditions within the office I believe their censure would be changed to admiration that the work is so well done that such references are not more frequently found. The conditions within are vastly different from those without. With an examining force of 43 principal examiners and 344 assistant examiners and with receipts of over 200,000 cases, old and new, per year (the number in 1916 being over 240,000) and the desire to keep the work from continually dropping backward it is quite easy to calculate how much or how little time *can* be put on a "case." In fact, an average of nearly 4½ new and 11¼ old actions must be made by each assistant examiner, each week, in order to keep abreast of the receipts. Comparing this time with that which is given by an attorney in making a validity search, the wonder is that a much larger proportion of patents is not found invalid. Furthermore, the examining force in the office is continually changing. Owing to the low salaries paid the force, compared with prospects outside the office, the greater number of men entering stay only long enough to become well acquainted with the work, in the meantime studying law or other subject and when that is finished, resigning. Hence, at all times, a larger number of the force can only be called apprentices. This condition is serious. The office should have a larger force and that force should be given increased salaries sufficient to cause the greater number to remain in the service. In this respect such associations as this, working unitedly, could render the greatest assistance. In fact, I believe this to be the real solution of the problem.

Although the most frequent cause for the holding that a patent is invalid is that of anticipation by patents or by disclosure in publications, there are other reasons. A patent may be held invalid if it is proven that the invention has been in public use or on sale by any one, even the patentee, for more than two years before the application for the patent was filed, or it may be held invalid if it is proven that another party invented the subject-matter before the patentee; or if the patentee himself was not the actual inventor. If the last named conditions should exist the patentee, unless self deceived, must have sworn falsely when he made his application and might find himself before a federal judge on the charge of perjury. However, the patent office is not in a position to have knowledge of either of the three conditions mentioned above and cannot be in any way blamable if they should be proven.

PATENTS FOR ALLOYS

In the first place the question might be asked why or for what purpose patents for alloys are obtained.

As a brief answer to this question I might say that patents for alloys are obtained for the same reason as patents for machines, processes and other subjects-matter, namely, that the patentees hope that by such patent they might be enabled to increase their bank accounts. Although I regret that this beneficent result does not always occur, still in frequent cases inventors are successful to a greater or less extent, so that others, imbued with hope or probably endowed with a gambling instinct, make use of their inventive talents and help to swell the revenues of the patent office and make certain the payment of the salaries of its employees, by themselves filing applications for patents. Alloys would naturally fall under the subject of composition of matter. Many patents have been granted for alloys *per se*, and for alloys for a particular purpose. In regard to patents for alloys adapted for general use, there is some difference of opinion as to the propriety of granting them, on the ground that it does not require the exercise of invention to mix and melt together two or more metals. Advocates of that theory argue that anybody could do this. They compare it to the mere mixing of substances other than metals and consider that the result would be known beforehand. For example, comparison is made with medicines. As a rule patents for compounded medicinal remedies are generally refused on the ground that the ability to so compound them is that of an ordinarily good physician who knows, as he should, the properties thereof, either when used alone or when mixed with others. This practice I consider correct. But the alloy is a peculiar thing. Knowing the properties of various metals, individually considered, it is not possible, in many, if not in all cases, to predict the corresponding properties of their alloys. For example, the melting points of two metals are known. It might naturally be assumed that when they are alloyed in equal proportions, the melting point of the alloy would be the average of the melting points of the constituents, but as you all know, this is not the case. Some fusible alloys, for example, melt at a temperature below the boiling point of water but the melting point of each of its constituents is much higher. The same holds good with the coefficient of expansion. For example, iron and nickel each has a considerable coefficient of expansion and who could predict beforehand that an alloy of the two metals containing 36 per cent of nickel would have practically no coefficient? Various illustrations with respect to other properties might be given. Hence, I consider that such alloys are proper subjects for patents especially if the alloy has some useful function in *any* art.

This argument is not, to any extent, made against an alloy for a particular purpose, and so stated in the patent. As examples of some particular purpose I can mention armor plate, journal bearings of some various definite articles composed of particular alloys.

In considering the value of a patent for commercial purposes, a knowledge, or probable knowledge of the scope or breadth of interpretation of its claims is one of the most important factors. Naturally a patentee is

anxious to have his patent construed as broadly as possible. In determining this question the courts have laid stress upon the fact of the patent being for an improvement on an old invention or its being for a subject-matter entirely new, or, as it is called, a pioneer invention. If the latter be the case parties have been held as infringers whose devices or compositions were very distinct from that of the patentees. An illustration of this doctrine is found in a late suit on an alloy patent. In 1906 Carl Auer von Welsbach obtained a patent (No. 837,017) for a pyrophoric alloy, having, as its first claim:

"A pyrophoric alloy containing cerium, alloyed with iron, substantially as and for the purpose described."

In 1910 Adolph Huber obtained a patent (No. 967,775) for a pyrophoric alloy composed essentially of cerium, magnesium and hydrogen.

Suit was brought against the Huber alloy as an infringement of the Welsbach alloy, even though it contained only one of the elements (cerium) of such alloy. This contention was sustained both in the District Court, Southern District of New York, and, upon appeal, by the Circuit Court of Appeals, Second Circuit, and mainly on the ground that the Welsbach alloy was a pioneer invention, that is, the first pyrophoric alloy invented or discovered containing cerium. Apparently if the alleged infringers had discovered and shown to the court some alloy, older than that of Welsbach, containing cerium as one of its components, his patent would have been interpreted as one for an alloy of cerium with iron (or some known equivalent) and the defendant would have been freed from the charge of infringement. As the case now stands the Huber patent may be valid in itself to the extent of the terms of its claim, but still be subsidiary or tributary to the dominating patent of von Welsbach.

Patentees are also given the benefit of equivalents of features forming a part of a claim; that is to say, a feature that is known to perform the same function in the same way as a feature in the claim. This is very common in mechanical structures. For example a weight and a spring are well-known equivalents for each other in many mechanisms; likewise a crank and an eccentric. Other examples can readily be brought to mind. Hence a patentee whose mechanical claim includes a cam as one of its parts, can generally prevail against an infringer who uses all of the parts of this claim, except that he replaces the cam by an eccentric. Of course, this principle is not universal, for occasionally an instance might be found where one is not obviously an equivalent for the other. This principle is not so clear or so common in regard to chemical equivalents (in which class we may place alloys) since chemical equivalency is not as self-obvious as mechanical. Nevertheless the principle holds good. One example of such a case is found as far back as 1872, where it was held that

> "A patent for a paste having as one of its ingredients chloride of sodium is infringed by a paste in which is used chloride of zinc, a known chemical equivalent of chloride of sodium for such purpose; the other ingredients being the same as the patented compound."

This principle applied to alloys as well as to chemical compounds.

An expression used above "for such purposes" calls to attention another important point in the determination of patentability. If, in a suit, a patent, or machine or other alleged anticipation is introduced, the question is generally raised, whether it is for the same or for a different use; that is, whether its use is analogous or non-analogous. As a general principle, courts have held that a new use of an old device or process may be patentable if such new device is not obvious to one having an ordinarily good knowledge of that art. If the new use would not suggest itself to such a person, knowing only the old use, patents therefor are generally sustained (as to this question). For example, patent No. 655,402, granted in 1900 to J. C. Hendrickson and G. H. Clamer for a bearing made of certain alloy, was in suit. In the lower court the patent was sustained, notwithstanding the production by the defendant of the analysis of an old Roman coin having a composition within the limits expressed in the claims of the patent. This was held to be not an analogous use. The fact that a certain alloy could be used as a coin would not intimate that it would make a good journal bearing. On appeal the patent was held invalid, but on a different ground, and later the patentees applied for a reissue, attempting to overcome the objections of the court. This reissue was granted. See patent to Clamer and Hendrickson, reissue No. 12,888, Nov. 17, 1908. As far as I know this reissued patent has not been involved in litigation.

Another alloy patent for a particular purpose has lately been litigated. The Hoskins Company, assignees of a patent to Marsh No. 811,859, granted February 6, 1906, sued the General Electric Company as infringers. The claims of the patent were for a resistance element formed of an alloy of nickel and chromium. Different claims recited the same elements in different language. The resistance wire of the defendants contained these two elements together with some iron and manganese. The defendant was held to infringe, the court holding that the iron and manganese contained in its wire did only what they would be expected to do and their use did not avoid the patent.

Very few patents covering alloys appear to have been involved in litigation. I have here mentioned those that appeared to contain some principle of general interest. One suit heard in 1915 involved two patents Nos. 1,071,-364 and 1,105,341, wherein both patents were held invalid by the District Court, but on ordinary and common grounds, such as public use, anticipation or the like, the only point of general interest being than an expression, sulphur "not exceeding" 12 per cent, and similar expressions as to other ingredients might include alloys containing *none* of that ingredient, and therefore such element might be ignored as being immaterial.

There are many features in connection with patents and patent practice that are important. In this paper I have selected a few that appear to me to be fundamental and which I trust will be of general interest.

CORROSION OF TINNED SHEET COPPER.

The United States Bureau of Standards has recently investigated a rather unusual and interesting case of corrosion, namely, that of the roofing material of the Library of Congress. The roof of this building has been covered since about 1893 by tinned sheet copper, which has become covered within the last 10 or 15 years with small pits; in many cases these pits have extended completely through the sheet. Such a condition is interesting, particularly in view of the fact that Washington is uncommonly free from smoke, etc., which is ordinarily understood to be a strong accelerating factor in corrosion.

The investigation has shown that the corrosion was due to no accidental inferiority of the material, but that it is to be considered as characteristic of all material of this type. It, therefore, appears that tinned copper is not superior in any way to tin plate for roofing material and in view of its greater cost can no longer compete.

Tinned sheet copper is used also for containing vessels such as milk cans, and for fittings such as troughs, etc., for soda fountains and breweries. It is probable that such articles would also be subject to pitting corrosion of the same type if they are not worn out by actual abrasion before the corrosion proceeds far.

CHINESE METAL MANUFACTURES

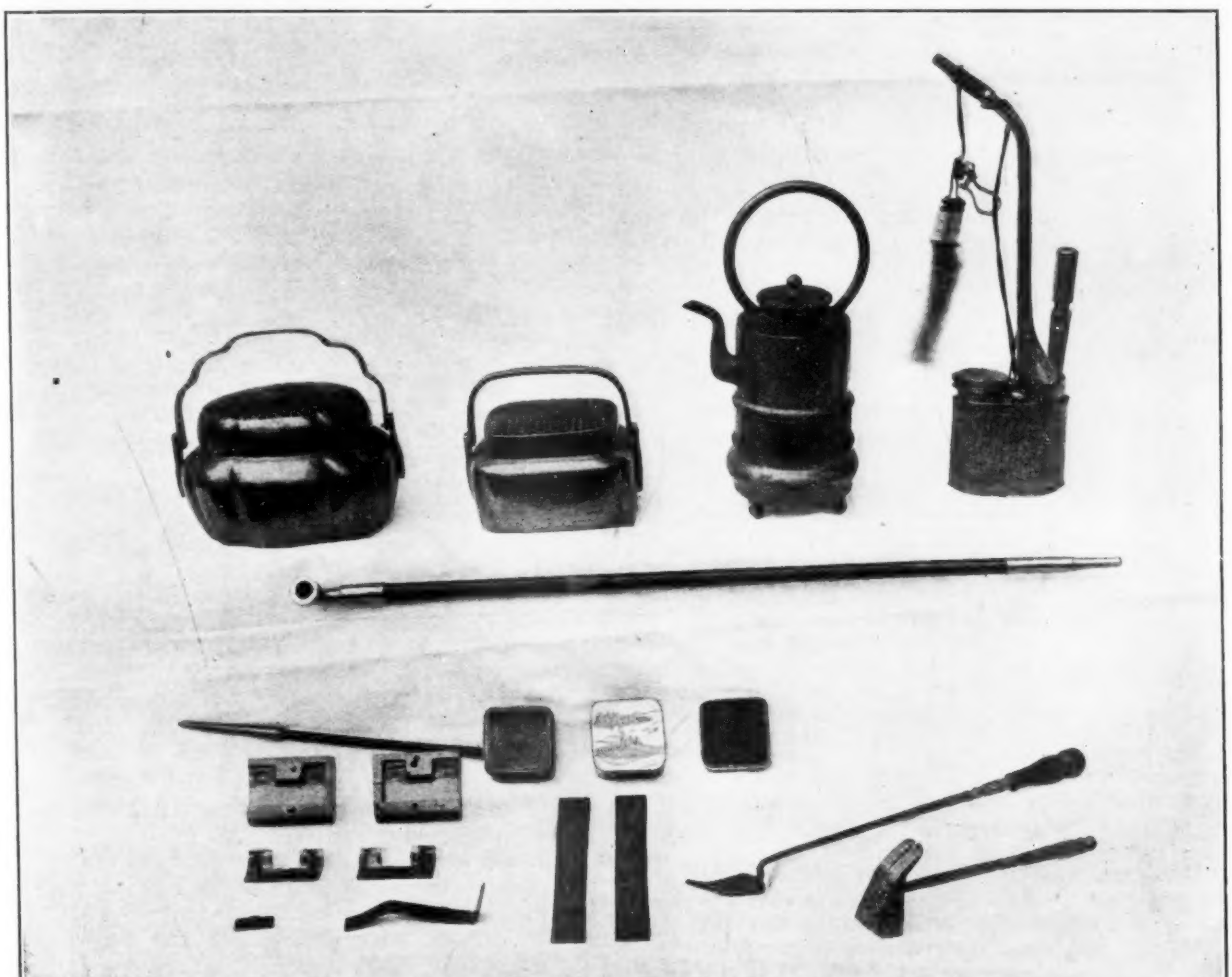
A DESCRIPTION OF THE PRODUCTION OF ARTISTIC ARTICLES IN SILVER, COPPER, BRASS AND PEWTER BY THE METAL WORKERS OF INTERIOR CHINA.

WRITTEN FOR THE METAL INDUSTRY BY H. K. RICHARDSON.

SECOND PAPER.*

HAMMERED WORK.

The first steps in the production of hammered work is the casting of the metal; this is usually cast into bars of approximately one inch x one inch x ten inches. This bar is then patiently peaned out to the required thickness. Frequent annealings are made during the process, cleaning is left to the end. Intricate shapes are made from beaten shapes soldered together. The soldering outfit is described under pewter working. The soldered joints are treated so as not to show. It may be of interest to note that the bronze from which No. 1 was cast came from the ruins of the famous bronze temple on the Golden Summit of Mount Omei, the sacred Buddhist shrine of Western China. This temple was struck by lightning during the 16th century and the ruins lay untouched until about 1912 when the revolutionists being short of cash sent an army to the top to collect the bronze which was minted into coins. They did such a thorough job that only the mere scraps remained when we visited the place the following summer. The present temple contains a few exquisite panels that were left standing when the original temple fell. These, together with two beautiful urns, testify to the wonderful workmanship of those early ages. It is unfortunate that the remaining panels are in such a dark place that only on exceptionally bright days can they be seen at all. On the road to the top of this mountain is the temple of Wan Nien Si—"10,000 years temple." In this temple is a bronze casting of Puhsien seated on an elephant's back. The statue is fully three times the size of a normal elephant and is finely finished. How this colossal casting was ever carried up the mountain side is a mystery. This elephant is claimed by some to be the world's oldest existing monument.



EXAMPLES OF CHINESE HAMMERED OR WROUGHT METAL GOODS.

Top Row—Hand Warmer with Engraved Top. Hand Warmer, Students Work. Wine Pot with Alcohol Stove for Heating. Engraved Water Pipe. Middle Row—Cigar Holder, Cast Cigar Pipe, Cast Mouth Piece. Bottom Row—Brush Pin Protector, Cast. Lock Mold, Wrought. Ink Mold, Wrought. Rulers, Engraved. Tailors Tools: Seam Ironer, Seam Smoother and Thread Puller.

TURNING AND DRILLING OR ROUGHING DOWN THE PRODUCT.

Both hammered work and castings are roughly brought to shape by turning wherever possible. If any

holes need to be drilled these are first taken care of. The drill in use is the old Indian fire drill, a steel point fastened to the end of a stick, which is caused to revolve by a leathern strap attached to a heavy wooden block. Such a drill is shown in Fig. 6.

Articles that can be turned are treated in one of two ways:

(1) HAND TURNING LATHES.

These are very crude, simply a wooden axle secured to a block of wood by iron straps. One end of the axle has

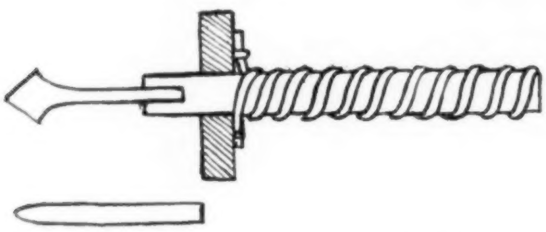


FIG. 6. A CHINESE METAL DRILL

a crank for hand turning. To the other end the article is secured by wax or glue. The turning tool is supported on a stake driven into the ground in front of the business end of the axle. Usually two men turn the crank while a third manipulates the turning tool.

(2) FOOT POWER LATHES.

These are similar to the hand lathes except that they are mounted on a framework and are manipulated by one man only. The workman works two pedals con-

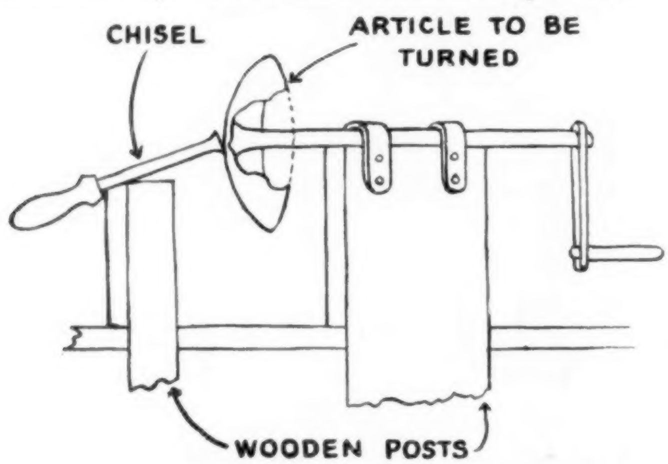


FIG. 7. A HAND-POWER CHINESE METAL LATHE

nected by a leather strap which passes over the axle. Thus the axle is given a reciprocating turning movement first to the left and then to the right. It is surprising how dextrous an operator becomes in overcoming the reversing character of this motion. The operator sets at his work on a saddle built at one end of the framework. These two lathes are sketched below, Figs. 7 and 8.

CLEANING AND FINISHING.

All work cast and hammered, even if turned, is filed, scraped, then polished. The scraper used is but little different from our customary lead burners scraper. Practically all filing is done on a bench equipped with a filing vise. This crude apparatus is so wonderfully effective that it warrants further description.

A sketch of one of these arrangements follows, Fig. 9.

The noticable things in the above arrangement are the double handled file and its method of use. One handle of the file is slipped through the eye bolt at the back of the bench, the work is placed on a block between the eye-bolt and the workman, and it is held firmly by a leathern foot strap or vise. This arrangement allows considerable pressure to be brought to bear upon the work. It is surprising the progress that a Chinese worker can make using this apparatus. The first file used is a coarse cut, 14

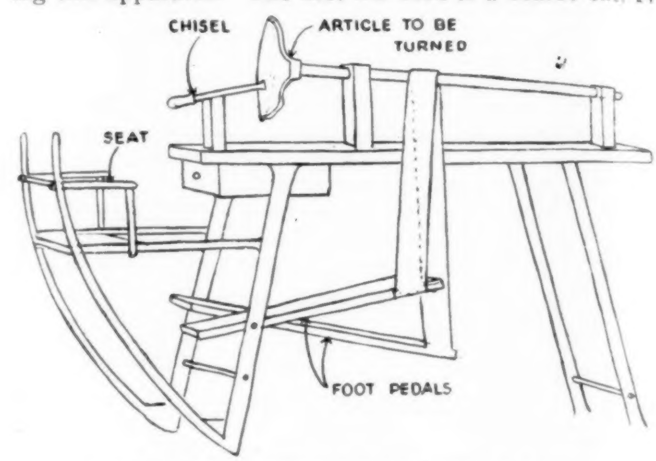


FIG. 8. A FOOT-POWER CHINESE METAL LATHE

inches long x 1½ inches wide. All files are cut by hand. Formerly only native steel was used; nowadays considerable German steel finds a market for this purpose.

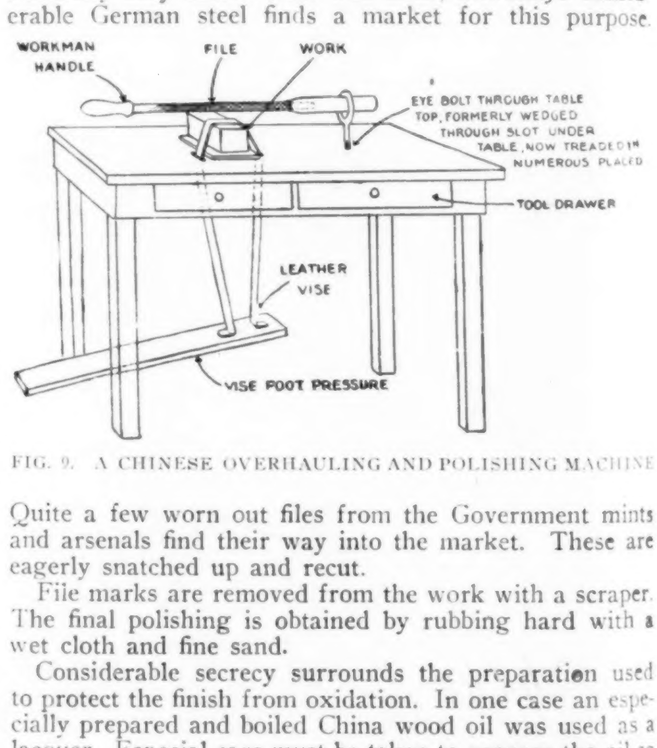


FIG. 9. A CHINESE OVERHAULING AND POLISHING MACHINE

Quite a few worn out files from the Government mints and arsenals find their way into the market. These are eagerly snatched up and recut.

File marks are removed from the work with a scraper. The final polishing is obtained by rubbing hard with a wet cloth and fine sand.

Considerable secrecy surrounds the preparation used to protect the finish from oxidation. In one case an especially prepared and boiled China wood oil was used as a lacquer. Especial care must be taken to prepare the oil so that it will not discolor the brass.

(To be continued.)

NEW PROCESS FOR SODIUM CYANIDE.

A new process for the fixation of atmospheric nitrogen which produces sodium cyanide and on further treatment ammonia, has been put forward by Prof. John E. Bucher. Coke, sodium carbonate and iron borings are raised to a red heat in an atmosphere of nitrogen or producer gas, forming sodium cyanide. By boiling this with caustic soda, ammonia is readily obtained. While this process is only in the experimental stage now, it is understood that an operating plant is being erected and that a nitrogenous product of some character will be placed on the market soon.

BRASS ROLLING MILL ALLOYS

A Paper Presented at the Boston, Mass., Meeting of the American Institute of Metals, September, 24-28, 1917.

By R. A. Wood.

The non-ferrous alloys such are are employed in the brass rolling mills for the manufacture of sheets, strips, wire, rods, tubes and shapes of various cross-section designs, must be made from mixtures which permit of their elongation and reduction of cross-section area without fracture. This, consequently, places certain restrictions upon the selection, quality and quantity of the metals which are to be used in making up the alloy.

By far the greater proportion of the brass rolling mill alloys are made up from straight copper and zinc mixtures, and these same mixtures with the addition of a small quantity of another metal or metals constitute a majority of the brass rolling mill alloys. The fabrication of some of these alloys is a simple matter, whereas others require an amount of skill and ingenuity only acquired by long practice.

The metals employed for making up the alloy must be of a good quality and practically free from impurities. Great care must be taken to avoid even traces of antimony or bismuth, for if these metals are present in the alloy, even in a fraction of a per cent., they will have a tendency to cause it to break up during fabrication; also, the chances of the metal fire cracking during the annealing operation are increased and if, by any chance, the metal should successfully pass the fabricating and annealing operations season cracks will most likely make their appearance, sooner or later, in the finished product. Copper and its alloys readily absorb sulphur, if given an opportunity to do so, and this has a tendency to cause the metal to become spongy and porous in spots; if sulphur is present in any considerable quantity it will cause the metal to become brittle and to break up during fabrication. The absorption of the sulphur takes place during the melting operation and is caused by the metal not being properly protected from the gases of combustion. Care should be taken to select a fuel as free from sulphur as circumstances will permit. Charcoal, when broken up into fine pieces, has the property of absorbing sulphurous gases and care should be exercised to see that the metal is protected with a good covering of charcoal during the melting operation.

Metals containing arsenic to any considerable amount should be avoided for the influence of this metal upon the alloy is very similar to that of both bismuth and antimony.

The quality as well as the quantity of the zinc used for making up the mixture has a bearing upon the physical characteristics of the alloy and care should be taken to select a grade of zinc suitable for the uses to which each particular alloy is to be applied.

Only the best grades of copper are safe to use in making up the alloy and it is well to have the copper cut up into as small pieces as are practicable in order that it will not protrude over the top of the crucible and be exposed to the gases of combustion.

STRAIGHT COPPER AND ZINC ALLOYS.

A mixture made up of approximately 50 parts of copper and 50 parts of zinc represents the highest content of zinc the alloy may contain and still be "workable." It is possible to roll an alloy of this nature into a sheet or draw it into a wire, but the operations are so tedious as to limit their being carried out on a commercial basis. This alloy is commercially used as either "fine" or "long-grain" spelter-solder and is used for brazing purposes. The grain of the solder is controlled by the heat at which the metal is poured. Cold pouring and rapid cooling will produce a fine grain solder whereas hot pouring and slow cooling produces the long "needle" like grain. The solder is broken up by means of a stamping or grinding operation, at what is called a "black" heat; that is the color the metal assumes under the influence of heat, as it turns from a yellow to a dark red color. The soldering opera- is usually carried out in conjunction with a flux having calcined-borax for a base.

Alloys made from mixtures of from 57 to 63 parts of copper and the balance zinc are used in the extruding process for making rods, tubes and shapes of varying cross-section area. The extruding process is carried out hot, but the work is, as a rule, given one or two cold finishing operations on a draw bench. Mixtures of this nature may also be rolled hot and are representative of the commercially hot worked alloys. These mixtures are known under various trade names such as Muntz metal, yellow metal, yellow sheathing, condenser tubing, extruded metal, etc.

The grade of metal to be used for making the "hot working" alloys must be carefully selected and the casting operation carefully carried out. This does not mean that it is always necessary to buy new material as there are mills which make a practice of buying up scrap and melting it in a reverberatory furnace after which it is cast into bars which may be either rolled hot or extruded; but the mills which are doing this successfully have a highly specialized melting crew who can tell from experience and certain physical tests when they have the metal in the proper condition for casting the bars.

A mixture made up from 60 parts of copper and 40 parts of zinc is about as cheap an alloy as can be successfully worked cold, although there are mixtures composed of from 57 to 59 parts of copper and 43 to 41 parts of zinc which may be rolled into sheets or drawn into wire. Alloys of this nature are used mostly for hard soldering purposes.

The successful working of the foregoing mixtures depends primarily upon the skill with which the casting operation is carried out. Alloys containing a high percentage of zinc do not, as a rule, polish up nicely as the surface of the metal is more or less likely to have a pitted and streaky appearance.

The mixtures given below represent some of the alloys found in actual practice. These proportions do not represent the analysis of the alloys but are the weights used by the casters in making up their mixtures.

ANNEALING OF COPPER ALLOYS.

Extreme care must be taken in the annealing of these alloys and this operation should be entrusted to a competent workman. The alloys high in zinc are apt to "run" in places if slightly overheated. These alloys are very soft and pliable at a red heat but upon cooling they become somewhat hard and springy. If they are plunged into a tank of water immediately after being removed from the annealing furnace they will remain much softer than if allowed to cool gradually. This is more or less a risky procedure for if the plunging temperature is not

Trade name	Copper	Zinc
Brazing or hard solder	50	50
Extrusion brass	55	45
Extrusion brass soldering or spelter wire	57	43
Soldering or spelter wire (worked cold)	59	41
Muntz metal. Yellow metal	60	40

Check brass (baggage checks, etc.)	62	38
Cutlery brass (knife linings)	63	37
Hoop brass (pail hoops, etc.)	64	36
Common brass. Market brass. Pin wire	65	35
Drawing brass. Dipping brass	66	34
Shrapnel brass	67	33
Clock case metal. Extra spinning brass	68	32
Cartridge brass	70	30
Spring brass (extra quality)	72	28
Brazed brass tubing (extra quality)	75	25
Common low brass	80	20
Good low brass	83	17
Best low brass	85	15
Medal metal	86	14
Bronze (regular)	88	12
Rich or best bronze. Goldine	90	10
Gilding	93	7
Percussion cap gilding	95	5
Primer cap gilding. Copper strips	97	3
Copper (brass mill)	99	1

Metals which have been properly cast and rolled or drawn should, if rightly annealed, have a good surface and a close grain and it may be safely assumed that, in almost every instance, when a porous, open or coarse grained metal is encountered that the trouble is in the annealing operation.

Alloys containing eighty per cent. or more of copper often cause trouble due to the presence of small pinholes and blisters. The imperfections are at times as fine as

A PURE NICKEL POT.

An exhibit that attracted considerable attention at the Chemical Exposition held at the Grand Central Palace, September 24 to 28, 1917, was a pure nickel pot, as shown in the accompanying photographs, exhibited by the Bayonne Casting Company, Bayonne, N. J. This pot was of pure nickel and had a cover made of the same material. The dimensions of the pot itself were as follows: 3 feet, i. d., by 3 feet, 2 inches, o. d., and 4 feet 6 inches long, while its weight is 2,850 pounds. The dimensions of the cover are: 3 feet 6 inches in diameter, 1¼ inches thick, while it weighs approximately 900 pounds.

It is stated by the company that this is the largest nickel casting ever made in the United States.

just about right some of the metal will split and crack. These cracks are known as "water cracks" and they must not be confused with "fire cracks," which they closely resemble. If the hot metal is cooled off by means of a stream of water, such as is thrown from a hose pipe, it will cause "water cracks," but if the cooling operation is carried out by means of a fine overhead spray of water this difficulty will be practically obviated.

Fire cracks may be said to be of a mechanical nature and are caused by an unequal stress within the metal itself; as the metal is heated in the annealing furnace this internal stress causes an unequal expansion of the metal to take place which has a tendency to cause it to pull apart. A metal which has been thoroughly worked seldom fire cracks.

Season cracks may be said to correspond to delayed fire cracks and are caused by the gradual equalization of strains within the metal. However, overworked metals will, in some instances, develop season cracks. The grade of metals used in the alloy, the melting practice and the mechanical operations applied to the metal all, in a greater or lesser degree, contribute to the cause of season cracking.

The straight copper-zinc alloys containing more than sixty-five per cent. of copper, if properly worked, seldom cause trouble due to "water," "fire" or "season" cracking.

pin points and at others show pronounced blisters and spills or streaks upon the surface of the metal. These defects invariably have their origin in the casting shop and are directly traceable to faulty workmanship. Unfortunately it is often more easy to locate the origin of the difficulty than it is to overcome it; but if the caster understands the melting and pouring of the "rich" metal mixtures no more trouble need be experienced than with the alloys containing a higher percentage of zinc.

For making alloys high in copper such as the rich bronze and gilding mixtures some manufacturers have within the past few years installed large reverberatory furnaces suitable for melting copper in large quantities. The mixture is then made up by placing the required quantity of zinc in a previously heated crucible and then adding the molten copper to it, after which the mixture is stirred and poured into the molds in the usual manner.

LEADED COPPER ALLOYS.

The foregoing alloys may be classed as straight copper-zinc alloys and they all possess the common characteristic of being of a tough and tenacious nature, and will be found difficult to work under a tool for milling, turning, drilling or engraving purposes. In order to impart the free working qualities a certain amount of lead is added to the mixture.

The lead impairs the cohesive quality of the metal and alloys containing lead will not stand as great a reduction without cracking as will the alloys free from lead. Alloys containing lead do not have as close a grain as those which are free from it, consequently they do not polish up as nicely.

The leaded mixtures are as a rule poured at a lower temperature and care must be taken not to overheat them during the melting operation, as this will most likely cause very fine black specks to appear throughout the metal.

The following mixtures will illustrate some of the leaded alloys:

Trade name	Copper	Zinc	Lead
Extruded rod (free turning)	56.00	42.00	2.00
Extruded shapes	56.00	40.00	4.00
Collett brass (clock work)	58.00	39.50	2.50
Collett brass (clock work)	60.00	37.00	3.00
Clock brass (wheels and frames)	62.00	36.50	1.50
Clock brass (wheels and frames)	64.50	35.50	1.75
Brass rods (free turning)	63.00	35.00	2.00
Brass rods (free turning)	64.00	35.00	1.50
Die sinkers and engravers brass	65.00	33.00	2.00
Die sinkers and engravers brass	66.00	33.00	3.00
Block brass	67.00	33,00	0.75
Watch brass	68.00	32.00	2.00
Balance wheels (clocks)	70.00	30.00	2.00
Brazed tubing (for threading)	72.00	28.00	1.00
Brazed tubing (for threading)	75.00	25.00	2.00
Screen plates	76.00	22.00	2.00
Low brass (turning rod)	80.00	20.00	1.00
Low brass (free cutting)	83.50	15.50	1.50
Low brass (kick plates)	85.00	15.00	1.00
Extruding bronze	87.50	10.00	2.50
Bronze leaded (engravers)	88.00	12.00	1.00
Bronze leaded (free cutting)	89.00	9.50	1.50
Bronze leaded (hardware)	90.00	10.00	0.75
Bronze leaded (screw wire)	95.00	5.00	0.50

The above mixtures show the charges as weighed off by the caster and do not represent the analysis of the alloy.

There are many different mixtures bearing the same trade name and it often happens that two entirely different mixtures may, if properly fabricated, be made to answer the same purpose.

It often happens that a mill can produce an alloy which is suitable for a certain purpose whereas another mill using identically the same mixture will not be able to fill the requirements. The secret of success is the manner of fabrication.

OTHER COPPER ALLOYS.

For a number of purposes a very tight and close grained metal high in tensile strength is wanted. Alloys of this nature are generally produced by the addition of of tin to the base mixture. The casting of alloys of this nature must be carefully carried out, otherwise the surface of the finished material upon being bright-dipped or polished will show numerous fine white streaks and in some instances, slivers. The molten metal should not be brought to a higher heat than is necessary and the tin should be pushed under the surface of the metal as quickly as possible, shortly before it is poured. The mixture is then given a thorough stirring. Alloys containing tin seem to develop season cracks much quicker than some of the other mixtures and this is especially true of the spring tempered brasses.

There are a number of alloys which are made from a straight copper and tin mixture and these are known under the trade name of "tin bronze." Alloys of this description containing a small percentage of tin (one or two per cent.) will not be found difficult to roll, but the mixtures containing from five to ten per cent. of tin are not only difficult to cast properly, due principally to piping, but the rolling operation must also be carefully carried out. The successful working of these alloys depends a great deal upon the roller and if he does not understand his business, a good casting will not help much. The trick is to gradually get the grain of the metal started right, and after this has once been accomplished no further difficulty will be experienced with the rolling operations.

Care must be taken not to overheat the metal during the annealing operation and it should not be brought to a much higher temperature than a dull cherry red color, after which it is allowed to soak in the furnace until it has attained an even heat throughout its entire mass.

These mixtures when drawn into wire are sometimes hard in spots, and such spots are more or less brittle compared with the rest of the coil of wire. Such hard spots are generally due to overheating during annealing, the coil of wire being "burnt" in places.

The addition of a small percentage of phosphorus (generally in the form of phosphor-tin or phosphor-copper) greatly simplifies the casting operation as it tends to reduce the oxides and causes the molten metal to become more fluid and produces a more solid and malleable as well as a more ductile casting.

Alloys of this nature are generally put on the market under the name of phosphor bronze and each mill has its own mixtures, there being no particular standard. As a rule the phosphorus is aded to the mixture shortly before it is ready to be poured.

Following are some of the weighing charges for alloys containing tin:

	Copper	Zinc	Tin
Hot forging alloy	60.00	40.00	.75
Hot forging alloy	60.00	39.50	1.50
Hot forging alloy	61.00	40.00	.50
Hot forging alloy	61.00	39.00	.75
Spring brass	62.00	37.00	.75
Spring rods	63.00	37.00	.50
Bell metal	65.00	35.00	.75
Spring wire	67.00	33.00	.25
Reed tongues	69.00	30.00	1.00
Condenser tubing	70.00	29.00	1.00
Special cartridge	72.00	28.00	1.00
Spring brass extra quality	75.00	24.00	1.00
Low brass spring metal	81.00	18.00	1.00
Low brass dipping metal	83.00	17.00	.75
Pen metal	85.00	13.00	2.00
Medal metal	86.00	14.00	.25
Watch fob metal	87.50	12.00	.50
Oreide metal	87.25	11.50	1.25
Oreide metal	89.00	11.00	.50
Bronze (high color)	90.00	10.00	1.00
Bronze (shaft wire)	90.00	7.00	3.00
Bronze small shells	93.00	7.00	.50
Bronze chain	94.00	1.25	4.75
Medal metal (rich color)	95.00	3.00	2.00
Medal metal (rich color)	97.00	1.00	2.00
TIN BRONZE			
Chain and optical bronze	90.00	....	10.00
	92.00	....	8.00
	91.00	....	9.00
	93.00	....	7.00
	94.00	....	6.00
	95.00	....	5.00
	96.00	....	4.00
	97.00	....	3.00
	98.00	....	2.00

Many manufacturers do not consider it good policy to add phosphorus to mixtures containing zinc, claiming that it has a tendency to produce fine pinholes in the castings. This question may be open to some argument as the following commercial alloys containing phosphorus will indicate. The addition of too much phosphorus should be avoided as an overdose will not only cause

pinholes in the casting, but it will also increase the difficulties of rolling, due to cracking, etc.

Copper	100.00	98.75	98.00	94.00	94.00	93.00	88.00
Tin	....	1.20	1.00	4.00	4.00	4.50	....
Zinc	....	....	1.00	....	....	2.00	12.00
5% phos. tin	....	....	.50	2.00	....	.50	....
15% phos. copper	....	....	....	....	2.00	....	.50
Stick phos	....	1 stick	....	....	....	....	....

Many manufacturers consider .05 of phosphorus good practice.

For certain classes of work the trade calls for a metal having a very dense grain and exceedingly high in tensile strength and for alloys of this nature iron is added to the mixture. The shrinkage of the casting while cooling is excessive in alloys of this nature, and unless the melting and pouring operations are skillfully carried out the castings will pipe.

If the iron is not properly introduced into the mixture it will segregate throughout the casting in small nodules which are as hard as steel. It is generally customary to first make an alloy of copper and iron and the scrap clippings from horseshoe nails gives excellent results for this purpose. A little manganese in the form of cupro-manganese materially assists in distributing the iron evenly throughout the mixture.

The alloys containing iron are more or less hard and springy and some of the mixtures are very refractory, but if the melting and pouring operations have been properly carried out, they may be rolled or drawn, but the reductions cannot be as heavy as is the case if alloys are free from iron.

If spelter is used in making up the mixture, care should be taken to select a brand that is free from lead, for if any appreciable amount of lead is contained in the alloy it will break up during the rolling operation, or, if by any chance it withstood the rolling test, trouble would most likely be experienced, due to fire cracking. The lead would also cause the alloy to be low in tensile strength and thus defeat the object aimed at in making up the mixture.

Following are some of the mixtures containing iron:

Copper	57.00	60.00	70.00	82.00	92.50	94.00	60.00
Zinc	43.00	40.00	30.00	17.00	2.50	....	38.00
Tin	....	....	....	.75	3.00	4.00	.75
Iron	1.50	.50	.75	.25	2.00	2.00	1.00

The copper-iron-manganese alloy for introducing the iron varies in the different mills. One of the largest mills uses the following alloy: 86 copper, 4 pure manganese, 10 iron. This makes a ten per cent. iron alloy.

There is a demand throughout the builders' hardware trade for a metal that is both free turning and close grained and will take a high finish. Alloys filling these specifications may be successfully made by adding both tin and lead to the copper-zinc base mixtures. These alloys are very brittle at a low red heat, and extreme care must be taken in handling them.

The molds in which these alloys are cast must fit absolutely tight or trouble will be had with shrinkage cracks which have their origin in the fin or burr on the casting. Experienced casters sometimes avoid this trouble by knocking the mold down the moment the metal has set, this eases up the strain at the edges of the baw and prevents their cracking. Some of these alloys are as follows:

	Copper	Zinc	Tin	Lead
Block-brass	67.50	32.50	.25	1.50
Hardware bronze	88.00	10.00	1.50	1.00
Hardware bronze	90.50	9.50	1.37	1.25
Hardware bronze	90.00	8.75	.50	.75
Hardware bronze	90.00	8.00	.50	1.50
Hardware bronze	90.00	8.00	1.50	.75
Hardware bronze	92.50	7.50	1.50	1.25
Engravers bronze	90.00	8.00	1.00	1.00
Screw wire	94.50	5.00	1.00	.50
Die sinkers	86.00	10.00	1.00	3.00

These mixtures should all be poured at as low a heat as is consistent with obtaining a good casting. If poured too hot the metal will not only be more difficult to roll, but will very likely be "specky" as well.

COPPER NICKEL ALLOYS.

The nickel alloys are built up in the same manner from a copper-zinc base, two and one-half parts of copper to one part of zinc answering for most requirements. Tin is seldom used in connection with the nickel alloys, but iron, lead and manganese are often used in the mixtures, as the table below will illustrate. These mixtures, like all those preceding, represent the casters' weighing off charge and not the analysis of the finished alloy. The manganese is used in small quantities simply as a deoxidizer and not as an integral part of the alloy.

A very hard nickel silver such as is used for cutlery stock and extra hard springs may be made by adding from one-half to two per cent. of iron to the foregoing mixtures and by using from four to five ounces of thirty per cent. cupro-manganese as a carrier for the iron.

Kind	Nickel	Copper	Zinc	Iron	Lead
2 per cent	2.00	65.00	33.00	....	...
4 per cent	4.00	64.00	32.00	....	...
5 per cent	5.00	64.00	31.00	....	...
8 per cent	8.00	62.00	30.00	....	...
8 per cent. key stock	8.00	66.00	26.00	....	1.50
10 per cent	10.00	65.00	26.00	....	...
10 per cent. key stock	10.00	60.00	30.00	....	1.00
12 per cent	12.00	62.00	26.00	....	...
12 per cent, key stock	12.00	65.00	22.00	....	1.00
14 per cent	14.00	61.00	25.00	....	...
14 per cent. key stock	14.00	60.00	25.00	....	1.00
15 per cent	15.00	60.00	25.00	....	...
15 per cent. key stock	15.00	59.00	25.00	....	1.00
16 per cent	16.00	60.00	24.00	....	....
16 per cent. key stock	16.00	59.00	24.00	....	1.00
18 per cent	18.00	58.00	24.00	....	...
18 per cent. key stock	18.00	60.00	21.00	....	1.00
20 per cent	20.00	57.00	23.00	....	...
21 per cent	21.00	57.00	22.00	....	...
24 per cent	24.00	55.00	21.00	....	...
25 per cent	25.00	53.00	22.00	....	...
30 per cent	30.00	50.00	20.00	....	...
32 per cent	32.00	51.00	17.00	....	...

Cupro-nickel is made from a straight copper and nickel mixture, the nickel content varying from five to twenty-five per cent. To successfully make this alloy it is absolutely necessary that the melting furnace be so constructed that a very high heat is obtainable. This is particularly true for the alloys containing the higher percentage of nickel, and the temperature must be brought up to a dazzling white heat. It is possible to tell a good melt by noticing the surface of the molten metal; if the surface appears to be agitated and spits while the metal is being poured it is an indication of a porous casting. The molten metal, in order to make a good sound casting, should present a smooth and mirror-like surface. This result is difficult to obtain except by natural draft or an oil fired furnace. Every precaution should be taken to prevent oxidization during the melting operation.

Alloys having high electrical resistant qualities are made by adding manganese in varying quantities to the copper-nickel alloys. These are very difficult mixtures to produce successfully, and unless one thoroughly understands their refractory nature, trouble will be encountered. The rolling of these alloys is also a difficult matter, and in order to be successfully carried out requires considerable preliminary experimental work.

AN IMPROVED ELECTRO-ANALYSIS APPARATUS

A Description of a Method for the Rapid Determination of the Constituents in Copper Alloys

A Paper Read by Jessie L. Jones Before the American Electro-Chemical Society, Pittsburgh, Pa., October 6, 1917.

In the chemical laboratories of many of the larger manufacturing establishments, the volume of non-ferrous work is so great that the types of electro-analysis apparatus supplied by the dealers in chemical supplies, do not prove adequate.

The apparatus which forms the subject of this paper has been in use in the laboratory of the Westinghouse Electric and Manufacturing Company for about two years. There were incorporated in its design the good points of the apparatus previously in use in our laboratory as well as those forms on the market which we had purchased and tried out from time to time.

In its present form the apparatus is strongly constructed, compact, easy of adjustment and current control, and capable of turning out a large amount of work in a minimum time.

We have built and have in use, one ten-unit and two six-unit machines. Figure No. 1 gives a view of the ten-unit machine. One of the latter machines has been mounted on a convenient table and a demonstration will be made at this time of its operation.

Figure No. 2 gives the more important details of mechanism. They are:

A.—Drive shaft.
B.—Leather friction driver.
C.—Disc.
D.—Thrust ball bearing.
E.—Pressure spring.
F.—Pressure screw.
G.—Lock nut.
H.—Bearing.
I. —Shaft.
J. —Oil hole.
K.—Fiber bushing.
L.—Large electrode.
M.—Small electrode.
N.—Stirring rod.
P.—Hard rubber plate.
R.—Terminal screw.
S.—Hard rubber cup.

FIG. 1. A TEN-UNIT ELECTRO ANALYSIS MACHINE

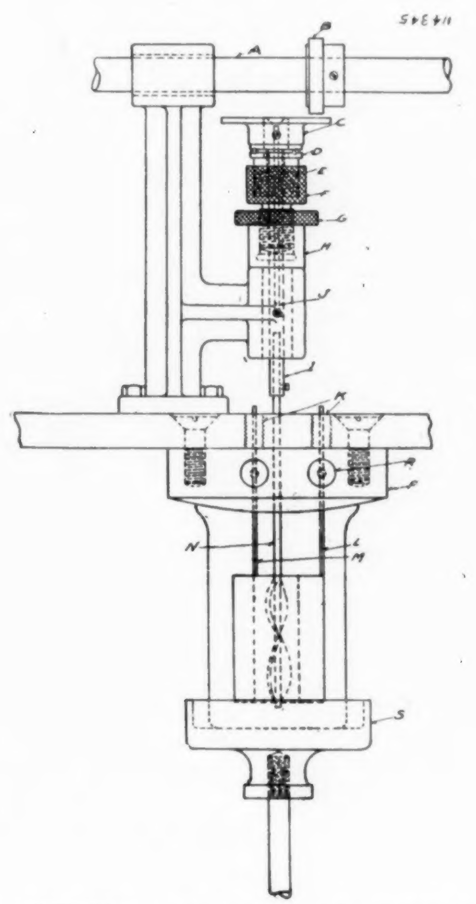


FIG. 2. SECTIONAL VIEW OF NEW ELECTRO-ANALYSIS APPARATUS

DRIVE SHAFTS, ETC.

The drive shaft is made of cold rolled steel and is directly connected to a 1/12 H.P. Motor, 1140 R.P.M.

The leather friction driver, disc and related parts furnish a means of throwing any spindle out of action at will and of also modifying the speed of rotation. The pressure spring enables the leather friction driver to be fastened securely in any desired position on the disc and is a valuable accessory for this reason. Its use was suggested by Mr. C. E. Skinner, engineer of the Research Division.

The leather friction driver and the thrust ball bearings give almost noiseless operation at this point.

ELECTRODES.

The electrodes are cylinders of platinum made from 40-mesh wire gauze. The large electrode weighs about 30

grams and the small electrode 16 grams, in other words they are as light as is consistent with the work they have to do. They are stationary and this enables them to be used with success for lead determinations as the deposit adheres well, which is not the case when a revolving anode is used. The use of the gauze electrodes assures rapid deposition and surface bubbles are to a large extent prevented. Although both electrodes are stationary and not subjected to the severe stresses due to rapid rotation, considerable trouble has been had with them due to the supporting rods breaking. The platinum obtainable during the past two or three years has been very inferior in quality and the prices high. The manufacturer insists that his refining methods have never been as good as at present and that his platinum was never before as pure, but the facts are that electrodes bought five or six years ago and that have seen hard and continuous service are still in good shape, while the platinum in recently purchased electrodes is hard and brittle, the supporting rods frequently breaking and in some cases after only a few weeks of service.

The speed of rotation of the stirrers may be varied from 300 to 1,000 revolutions per minute. To insure smooth running, the tungsten rods must be absolutely straight and this requires careful selection. A set screw has been found to be the most satisfactory method of holding the stirrers in position.

HARD RUBBER PLATE.

A hard rubber disc or plate, with a convex lower surface, carries the terminal screws for the electrodes and fits closely over the beaker that holds the electrolyte, thus preventing loss of the liquid by projection or from the fine spray that occurs during the electrolysis. The holes in the disc for the supporting rods of the electrodes and for the stirrer are made as small as possible for similar reasons.

HARD RUBBER CUP.

A hard rubber cup or holder, which can be adjusted to any desired height carries the tall glass beakers that are used for the electro-analysis. Beakers of from 200 to 400 c. c. capacity are used, the larger sizes being necessary

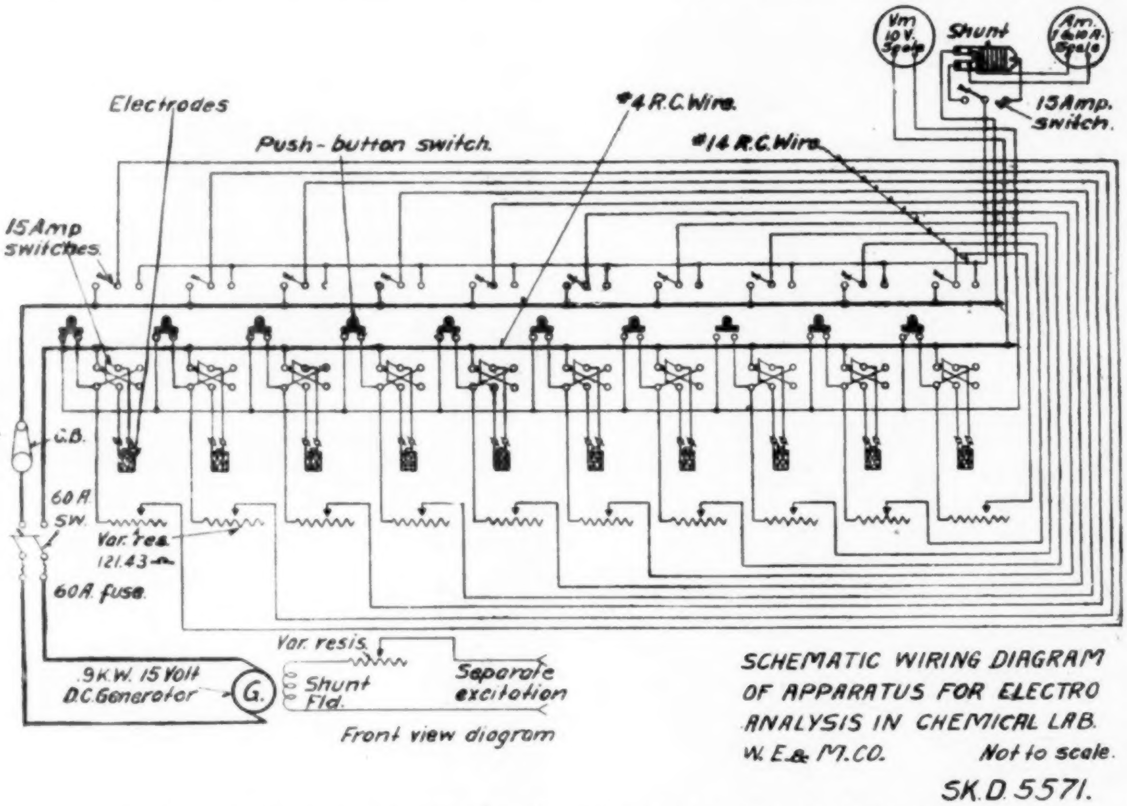


FIG. 3. WIRING DIAGRAM OF THE NEW ELECTRO-ANALYSIS TEN UNIT MACHINE

STIRRERS.

Our stirring rods were at first made of platinum and were shaped like propellers. Their frequent breaking and the fact that it would have been necessary to make them very heavy to have enabled them to stand up, lead to the development of a new type of stirrer which consists of a tungsten rod 3/32 in. in diameter and 8 in. long, with a glass screw fused upon it. These stirrers are stiff and strong and have been found to be much cheaper and more satisfactory than those made from platinum. They can only be used in acid electrolytes, however, as in alkaline solutions the tungsten is attacked. Where it is necessary to work with alkaline solutions, as in the case of electrolyzing ammoniacal solutions of nickel sulphate, etc., a coating of glass may be spun over the entire surface of the stirrer that is exposed to the solution.

for large samples of copper that are being analyzed for impurities which are present in relatively small amounts. Where it is desired to heat the solutions, a small disc electric heater is placed under the beaker.

INSTRUMENTS.

The ammeter has a range of from 0 to 10 amperes and by means of a shunt will indicate from 0 to 1 ampere. It is connected in such a way that readings may be taken at any spindle by throwing in the switch above the spindle. Similar voltmeter readings may be taken by means of the push buttons.

CURRENT.

The necessary current for the electrolysis is furnished from a 250 volt direct current line through a motor generator set that delivers 60 amperes at 15 volts.

RESISTANCE.

Rheostats conveniently mounted enable the maximum and minimum currents required for analysis to be obtained. Many types of electro-analysis apparatus are so wired that they have the same current at each unit, but with our arrangement each unit has a separate rheostat and a copper analysis may be run on one of them with 6 amperes and a babbit on the adjoining set at ½ ampere.

REVERSAL OF POLARITY.

The larger platinum cylinder is normally the cathode and the smaller one the anode, but the polarity may be changed at will by means of a double throw switch, the two positions being marked, respectively, cathode and anode.

WIRING.

A hardwood cabinet encloses the apparatus. The wiring is placed on the back of the cabinet, and Figure No. 3 shows it in diagram. Although injury to the apparatus from excessive current is not likely, it is guarded against by suitable fuse protection.

The design of the apparatus was made by Mr. F. R. Lauffer, mechanical engineer of the Research Division, aided by Mr. Edgar Cornell, Jr., alloy chemist.

CASTING BEARINGS IN SAND AND METAL MOULDS

A Paper Read at the American Institute of Metals, Boston, Mass., September 24-28, 1917.

By R. R. Clarke, Pennsylvania Railroad Company, Pittsburgh, Pa.

The subject originated in the membership of the Institute, reaching the program committee in the form of a request. At a meeting from which I was absent that committee saw fit to solicit a paper from me and this discussion is the consequence.

The request as submitted by the membership environed chiefly manipulative practice, the prevention of lead segregation forming a primary objective. Evidently it represents another of those S. O. S. calls sent out by troubled experience in dealing with an old foundry difficulty for which, so far as I am aware, no absolute solution has yet been worked out in every day practise.

The original plan of the committee called for two separate discussions, one covering the sand casting method, the other disposing of the iron or steel chill molding process. Unfortunately we were disappointed in the latter particular, rendering it essential to include both within the jurisdiction of this paper.

In a general sense, the bearing metals divide fairly sharply between those of low, those of conservative or medium, and those of high lead content. For convenience —and not otherwise unwarrantedly—the low lead metals will, in this discussion, include those containing up to a 10 per cent lead figure; the conservative or medium from 10 per cent up to and including 15 per cent of lead, and the high from 15 per cent upwards to 50 per cent, beyond which copper ceases to form the quantitative base and for which very few if any solid bearing demands at present exist.

Originally many bearing metals were copper-tin alloys thereby penalizing service with an expensive, hard, inflexible, fast-wearing and comparatively high-frictional and heating casting. Over all these the element lead has been found to exercise a strong neutralizaing effect and is now conceded a prime requisite to a high grade bearing alloy for representative service.

Elementarily, the difficulty encountered in working such alloys arises from the behavior of lead in copper which in turn traces to natural and all but irreconcilable differences between these two elements in combination. The first of these differences is chemical estrangement. Between the two is little or no affinity. Lead dissolves but slightly in copper, thereby limiting its voluntary incorporating ratio to from 3½ per cent to 4 per cent of the lead-copper mass. Above this range lead observes free state and must depend altogether on a mechanical setting for its distribution in the casting. Next we note the difference in specific gravity, that of lead being 11.3, of copper 8.9. Added to these are fusing and freezing temperatures which in difference approximate some 700° C. All these items of difference are by nature decreed and in sum total make for that composite situation from which the non-homogenous lead-copper alloy derives so generously.

Among those classes of particular service that plead strenuously for cleanliness and purity of metal, the bearing will always be honored. Journal engaging surfaces particularly must be clean, solid and free from oxide if satisfactory results are at all to be looked for. It is only natural then that some re-agents fall well within the manipulating range. Of those re-agents commonly resorted to, phosphorus is perhaps the most widely countenanced.

Here we meet another manipulative difficulty. Face to face in copper, lead and phosphorus are not any too congenial, the phosphorus tending to knock down the lead as well as to force it from any well occupied ground in the congealing mass. At any rate the sure consequence of increased seriousness always follows the introduction of phosphorus and accords it the advantage merely of relieving the situation in one quarter only to aggravate it in another.

Experience is all but common in evaluating the element tin, another of the primary requisites to a good copper-base bearing alloy. This ingredient will be foud active along many helpful lines. A peculiarity of this activity is the attitude of tin toward lead incorporation. If we combine equal parts of tin and lead with 90 per cent copper, we encounter no segregating difficulty. If we bring together 80 per cent copper and 10 per cent each of tin and lead as in 80, 10 and 10 we still experience practically no distress. If, however, we put 87 per cent copper up against 10 per cent lead and 3 per cent tin or try to work 75 per cent copper along with 10 per cent tin, 15 per cent lead, evidence of dissatisfaction begins to materialize. The inference is that by virtue of its perfect agreement with both lead and copper, the element tin arbitrates differences between these two elements in combination up to a certain point and under fixed ratios of tin to copper, after which its power wanes and proceeds to an antithesis of effect. It was this critical point in copper-tin ratio toward which the experimental effort of the late Dr. Dudley penerated. His object was an escape upward in lead from the standard 80, 10 and 10 alloy. His findings were that to increase lead, he would have to decrease tin, that to advance 5 per cent he must of necessity disregard the 89 parts copper, 11 parts tin as in 80, 10 and 10 in favor of the 91 parts copper, 9 parts tin as in his experimental alloy. This 91 to 9 ratio represents the doctor's determined value of the critical point. How near it approaches the absolute of principle we are not prepared to say but, whatever its tech-

nical status, there can be no doubt of its stability as an extreme practical limit in the alloy from which it derived its origin and over which it exercises its undoubted control.

All metals in combination fall under three distinct classes of union, the chemical, the physical and the physico-chemical. In any copper-base alloy to which the element lead contributes in reasonable quantity, the last named union is the very best, so far as the lead is concerned, that can be looked for. This is sometimes a decided advantage, as for instance in the high grade pressure-resisting alloys where a small quantity of lead used will mechanically fill in the pores of the metal to a densifying consequence. The argument holds, however, only for low limits of lead, which, when thansgressed, superinduce a heterogeneous casting structure, some parts rich in lead, others impoverished, some vicinities hard, others soft, some regions dense, others porous.

Segregation in an alloy is either the inherent or superinduced tendency of some component element or elements toward isolation in the solidifying and solidified mass. With respect to lead in copper it is a perfectly natural affair deriving from purely mechanical principles. Simply obeying their laws, certain natural forces are at work compelling a change of position. There is nothing any more mysterious about it than the settling of particles of positive specific gravity to the bottom of a pail of water or a dentist squeezing between his fingers the excess mercury from his amalgam filling.

Basically, lead segregation derives from the mechanical union, from the free state of lead in the mass whch in turn traces to a very low degree of affinity. Its separating movement proceeds chiefly through precipitation and by expulsion. The former is a downward movement controlled by gravity and occurs mainly in liquid state of the mass. The latter admits no well defined direction other than lines of least resistance and exists a consequence of contraction, liberating gases and molecular attraction. These forces, either singly or conjunctively operative, prolonged a lead movement more or less pronounced during the entire process of solidification and up until the freezing point of lead has been reached throughout the mass. It is manifest, not only in the cooling, but also in the heating of a casting above the lead freezing point. Bearings running hot in service sometimes show beads of molten lead on their surfaces. In such condition these beads can be swept off only to be replaced by others shortly reforming. This is evidence that something more than contraction explains the expulsion of lead since a rising temperature invariably gives expansion.

The result of precipitation is an abundance of lead in the lower molding vicinities of the casting and a poverty of the same element in the upper. That of expulsion is different proportions of isolating lead in different sections of the casting. Consequential to it also are a clean escape and resultant loss of lead from the casting with a perfectly reasonable sponginess and porosity forming a coördinating possibility.

In a casting correctly molded, a well regulated precipitation of lead will find several mitigating arguments in the conditions of good service. To our mind the ideal bearing casting includes a plastic, antifrictional bearing surface fading away in a hard, rigid, compression-resisting background. We believe, further, that a net-work of soft and hard particles in-setting the ground-mass of a bearing surface such as might follow a precipitation of lead distributing uniformly throughout a normal copper-tin-lead surface structure, to be a condition with which any average journal service might well be satisfied. Still further the mechanical elimination of an abnormal porosity in finishing limits is a resultant benefit in that the receptacles for accumulating dust and grime become thereby a more remote possibility. These features we believe to be among those practical advantages arising from an unavoidable yet judicious deposition of lead and a correct molding practice as realized by casting the journal-engaging surface in the drag of the mold.

But we must strive to escape an over abundance of lead in the journal surface and too pronounced isolation of lead throughout the mass or a total loss therefrom, to all of which great manipulative caution is essential. Practical everything connected with such manipulation is mechanical and becomes thereby a most pronounced concern in the many little ordinaries of daily practice included in this phase of the subject. In other words, to obtain results we must accord every little detail of practice a faithful and pronounced significance whether appearing to warrant such importance or not.

The low lead alloys are happily exampt from those decreed conditions from which an exaggerated segregation has no absolute escape. There is, therefore, no good reason why the situation should outrun any foundryman. If the ratio of tin to copper be kept within reasonable bounds, the phosphorus held to safe limits and melting and molding practice dominated by logical principles, no irreducible difficulty can arise. Consider for instance the well known 80-10 and 10 alloy with a ½ per cent to 1 per cent phosphorus complement. No more manipulatively congenial metal could be desired. It works best, of course, on second melting, though satisfactory results obtain from combining and pouring direct. In combining we have found improvement to follow adding the tin and lead in combination the two thus entering the copper bath and holding together better than as if forced to find each other following their separate introduction. Vigorously stirring the metal as tin and lead are introduced favors results. To neglect this measure or execute it in a half-hearted way invites a detrimental consequence more or less assertive. In making the mold, the sand should be of good body, rather dry and tamped hard since hard surfaces favor rapid freezing of metal. Facing the molds well with plumbago is another contributing factor in that this substance also exercises a chilling function besides adding to the smothness of the rough casting. Invariably the molds when of sufficient depth should be gated at or near the bottom and poured hard to superinduce an upward and distributing movement in the rising metal. As to pouring temperature it should be as low as results otherwise dependent will admit. Hot metal taxes the mold, prolongs its liquidity in the mold and undoubtedly favors lead segregation.

To minimize the lead sweating evil, casting should be left in the sand until cooled below the freezing point of lead. Above that point this sweating is an ever menacing possibility and arises from the tendency of a sudden change in temperature to abruptly increase the pace and expelling power of contraction. To the practice of pouring water on castings to hasten their cooling the same argument even more emphatically applies. Molden position is a further significant item. The horizontal with journal core in the drag is undoubtedly the logical method for those patterns falling within this molding range. Molding castings such as crown-brasses in vertical position or "on end" are sometimes countenanced. It is a method we have tried and discarded for obvious reasons already analyzed. These are but a few of the great mass of considerations involving purely mechanical measures toward lead control. As previously indicated, some are not vitally essential though any or all can be well accorded recognition in the prescribed routine of safe practice.

Advancing to the conservative or medium lead product we find these same measures absolutely imperative. It's a ticklish situation this, where lead and copper have advanced far beyond the breaking point, with tin standing ready to desert the very position we have relied upon it to take. It's a critical point to be sure and one to which the benefit of doubt has to our mind in no wise been denied; 78-7-15 with phosphorus is no self instituting combination with respect to lead incorporation and must be handled with judicious care. We have known many castings to be lost through lead segregation and lead loss from the casting which usually observes greatest prominence in the last four or five molds poured. This is unmistakable evidene of precipitation in the crucible and clearly establishes the necessity of vigorous and repeated stirring. The alloy's great handicap is that, including phosphorus, such critical equilibrium prevails as to render the delicately adjusted balance extremely difficult to perpetuate. The behavior of the metal leads us to often seriously question that there is any such balance, at least any that might be termed either self instituting or self supporting. Certain it is that the lead will fall and the castings "bleed" under ordinary practice which is evidence that results must depend as fully on manipulating detail as on either the power of tin or the well balanced ratio. Obviously the only remedy lies in keeping the phosphorus down to a mere trace, melting and pouring from medium sized rather than large crucibles, stirring vigorously and repeatedly from the bottom up, and observing most faithfully all the other mechanical means of prevention referred to in connection with the low lead mixes.

In copper-tin; 15 per cent of lead marks a well established and accepted practical limit. Beyond that nothing definitely assuring appears. Results might accidentally follow in light castings or in medium castings observing rapid-cooling form but in the great majority of heavy, chunky castings so liberally accounted for in bearing service demands, they need not be looked for. Originally, and we might say creatively, this 15 per cent lead mix was never intended for a heavy casting nor an extremely particular service. The field to which its founder assigned it is the car journal bearing where the maximum sized casting at that time weighed 20 pounds. That it will apply to heavier and more particular service there can be no doubt but that its foundry manipulative difficulties will increase with bulk there can be as little question.

Of all combinations under discussion, the high lead mixes are the most mechanical. We have found them also the most troublesome. This is perfectly natural coincidence, a logical parallel from which we cannot expect to escape. The greater the surcharge of lead the more marked the tendency and expressive the result of returning to normal, of reinstating balance which is a supreme law of good mixing. The conditions are simply the more unnatural and the greater precipitation and expulsion of lead only the more natural. Experimentally we have stepped the lead by the common difference 5, from 10 per cent to 30 per cent and found the principle to faithfully operate.

As previously calculated, high lead observes a range from 15 per cent to 50 per cent or a 35 per cent lead margin. A representative mix might be said to embody 65 parts of copper, 4 parts tin and 30 parts lead. These alloys, if such they can be correctly termed, formulate on entirely different principles from the lower lead combinations. In them the power of tin is practically disregarded and the incorporating function delegated to an auxiliary agent, an added element or elements whose powers derive chiefly in the majority of cases from control of freezing points in solutions other than pure lead in the mass. Since this pure lead, though delaying its freezing to the last, can in no wise be termed a eutectic and since the eutectic of a 65 copper-4 tin-1 auxiliary-balance-lead combination must essentially be highly copper preponderating, it will readily appear that the value of the auxiliary reduces primarily to its capacity for adjusting differences between freezing temperature of an eminently high copper solution or set of solutions and the element lead. What the evaluated figures of these differences thus adjusted might be we are not prepared to say. In a practical and manipulating sense, however, we are positive of their significance.

(To be continued.)

NITRE CAKE FOR PICKLING.

In view of the high price now being asked for sulphuric acid and its extensive use as a pickling agent in the cleaning of metals, the by-product obtained in the manufacture of nitric acid known as Nitre Cake has found extensive use. This material, which has been in use for pickling purposes in the United States for the past two years, is now being made use of to a great extent in Great Britain. Some interesting facts relating to the material and the way it is handled in England were given in a paper read by H. W. Brownsdon before the Birmingham section of the Society of Chemical Industry. A brief synopsis of what Mr. Brownsdon said is as follows:

Nitre cake is essentially crude acid sodium sulphate, and while the later in the pure anhydrous state contains theoretically 40.8 per cent of sulphuric acid, the free acid found in nitre cake may vary from 5 to 30 per cent. For pickling, the nitre cake solution should show 3 to 5 per cent sulphuric acid on titration; there is no advantage to be gained in using solutions of higher acid concentration.

While nitre cake is a variable product, annealed brass from a pickling point of view may be even more so. Given clean work, nitre cake solutions replace dilute sulphuric acid quite efficiently, but with dirty work the difference is much more marked, and nitre cake solutions, even under the most favorable conditions, may fail to pickle the work satisfactorily. It is little consolation for the manufacturer to know that his troubles lie in his annealing furnaces. Much may be done to overcome troubles as follows:

The nitre cake solution should be as hot as possible.

Its acid content should be tested frequently and maintained at 3 to 5 per cent by addition of nitre cake.

The hot annealed products may be quenched in water whereby much scale is mechanically loosened prior to pickling.

The hot annealed work may be placed direct into the nitre cake solution, and the pickle can thus be maintained at a high temperature without auxiliary steam.

Oxidizing agents such as ferric salts, bichromates or per-sulphates may be added to the pickle, but in many cases the price is prohibitive.

Electrochemical aid might be sought by using a low voltage current, making the lead lining of the vat the cathode and the work to be pickled the anode.

Movement of the work in the pickle, or the agitation of the pickle during pickling, or both.

The difficulties met with in the successful use of nitre cake solution can only be overcome in a satisfactory manner by paying close attention to the conditions governing the annealing so as to obtain the annealed brass as clean as possible, and by using the nitre cake solution under conditions which will most strongly stimulate its pickling activity.

NEGATIVE EXPERIMENTS ON WASTE CORE SAND*

A Paper Presented at the Meeting of American Institute of Metals, Held at Boston, Mass., September 24-28, 1917.

By H. W. Gillett and E. L. Mack, Department of Interior, Bureau of Mines, Washington, D. C.

This paper is written because the secretary and the chairman of the Papers' Committee of the American Institute of Metals have asked that the experiments, though neither exhaustive or successful, be put on record.

In many foundries there is a considerable waste of "burnt core sand." Some part of the cores which are not too near the casting, can be put back in new core mixtures without harm. The skin next the casting, which is burnt by the hot metal, and which is also contaminated with burnt molding sand, requires much more linseed oil to give a strong enough core than is the case with new sand. The increased oil consumption is so great that it is economically impossible to re-use the burnt sand. Hence this sand must be sent to the dump, which involves expense, first for the sand itself, second for handling and loading, and third for freight and cartage. In some localities, car shortages have required temporary storage of the waste sand.

Mr. W. M. Corse, of the American Institute of Metals, and Mr. H. B. Swan, of the American Foundrymen's Association, requested this bureau to look into the waste core sand problem. The bureau therefore made a preliminary survey of the problem to see if the chances of success were good enough to warrant an exhaustive investigation. The material for the work was furnished by Mr. Swan, and was burnt core sand from the grey iron foundry of the Cadillac Motor Car Company. This was chosen because some work had previously been done by Mr. H. M. Lane on the reclaiming of this sand.

Unfortunately Mr. Swan had no detailed report of Mr. Lane's experimental work, and the bureau was unable to get more than the barest details from Mr. Lane. It is understood, however, that he attempted to reclaim the sand by washing with water, and also by air elutriation, the object being to get rid of the very fine particles that are supposed to be formed by shattering of the sand grains when the molten metal strikes them. An undue proportion of fine particles is supposed to consume more oil. Lane's standard was either Michigan city sand, or washed Ottawa silica sand, with linseed oil at the ratio of 1:50 and with about 4 per cent moisture. The standard test cores were baked 1½ hours at 400° F. Lane states that such standard cores should break at well above 100 pounds per square inch, but that he found that the burnt sand took oil in the ratio of 1:15 or 1:20 to give a core of the same strength as new sand in the ratio of 1:50. He states that in some cases, this was apparently caused by fine soft carbon, and in other cases, apparently by quick lime, which would of course saponify some of the oil.

Lane stated that the washed Cadillac sand contained cinders, or coke, from a sea coal facing used on the molds, which was not burned out, and that sand from foundries where sea coal was not used washed to a much cleaner product and gave much stronger cores.

The Cadillac Company uses in their linseed oil cores, a mixture of half lake sand and half bank sand, such as Rochester, with oil in the proportion of about 1:50, and sufficient water to temper the sand. The cores (of commercial size, larger than the test briquettes) are baked 3 or 4 hours at about 400° F. Sieve tests on the Cadillac sands gave the following results:

	A	B	C	D
			Standard 50 Rochester,	
Mesh	Rochester	Lake	50 Lake (Calc.)	Burnt Sand
20-40	0.5	3.5	2.0	5.5
40-60	1.5	24.5	13.0	23.5
60-80	15.0	65.5	40.0	47.0
80-100	10.0	4.5	7.0	7.5
100-200	57.5	2.0	30.0	13.0
Under 200	15.5	0.0	8.0	3.5
Fineness No...	138	80	108	87

Fineness number=sum of produce obtained by multiplying per cent sand remaining on sieve of given mesh, by mesh, divided by 100.)

Comparing the sieve tests, we see that Lake (B) is a coarse sand, with 90 per cent between 40 and 80 mesh, while Rochester (A) is a fine one, with 73 per cent below 100 mesh. The 50-50 mixture (C) is of course used to give a core of the proper porosity. Comparing the burnt sand (D) with the standard (C) we find an increase in all over 100 mesh and a decrease in all under 100, *i. e.*, there is an agglomeration of the particles probably due to the coking of the binder.

Since Lane's hypothesis was that the carbon in the burnt sand was the cause of the trouble, experiments were made to see if the carbon could be gotten rid of. As there is no solvent for carbon, the only apparent ways of eliminating the carbon are by mechanical means, such as tumbling and washing, and by burning it off. The burnt sand is black in color. Under the microscope this color is seen to be due to a carbon coating on the grains. This is an uneven coating, and the grains show black "whiskers."

On igniting in air the dry burnt sand lost 1.5 per cent and on combustion in oxygen, 1.7 per cent carbon was found.

Some of the burnt sand was ignited (Sample E) in a ½" layer in an open pan, raking over the sand now and then, and heating no longer and no higher than was necessary to burn off the carbon. However, this meant higher temperature and longer times than was needed on igniting in a thin layer, so another sample of burnt sand (F) was ignited in thin layers and kept in constant motion like popping corn. The ignited burnt sand showed no carbon coating. Where the "whiskers" had been, there was occasionally a wisp of reddish ash, but the main visible difference between this and new sand is that some of the grains have adhering to them large numbers of very much smaller grains—the agglomeration indicated by the sieve test. These adhere to the larger grain, like powdered sugar on a doughnut, and must give a rougher surface than the original to the larger grain, although it is a question whether such an agglomerate would require more oil than the large and small particles would before agglomeration, as in the new sand, if no other changes have taken place.

Samples of the burnt sand (D) and the regularly ignited burnt (E) were tumbled 4 hours in a 4" diameter x 4" high ball mill jar, the jar being about one-third full of sand. The center of the jar was 4" off the center of rotation, and the mill revolved at 50 R. P. M. No pebbles were used, just the sand alone. These tumbled samples were called, respectively, Samples H. and J.

This tumbling did not break up the particles at all, so no cores were made from these samples, but they were used for washing tests. The sands were washed in a stream of water, and about 25 per cent of the sand washed

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away, in order to get rid of the fine particles, and the resulting samples called respectively, Samples I and K.

Some of the standard 50-50 Rochester Lake mixture was ignited in the same way as Sample E was and still another sample of it (L) was heated 2 hours at 475° C., a sample removed, and the rest (M) ignited 2 hours more at 550° C. These samples were redder than the unignited standard. To test the ignited burnt (E) against the 50 Rochester, 50 Lake mixture for alkalinity, 10 gr. samples of each were extracted with 50 cc. boiling water, filtered and the filtrate titrated by N/50 H_2SO_4 with methyl orange indicator. Each took 1.0 cc. Ten gr. of each were stirred up in hot water and then titrated with the acid and methyl orange, directly. The 50 R. 50 L. mixture took 12 cc., and the ignited burnt 14 cc. The end-points were not clear because of the silt. The difference is not great enough to indicate that free lime formed to any appreciable extent in the ignited burnt sand. This argues against the hypothesis that free lime is the cause of the excessive oil consumption.

Sieve tests were made on the variously-treated samples and are given below:

Mesh	E Ignited Burnt Sand	F "Popped" Ignited Burnt Sand
20-40	4.0	5.5
40-60	16.0	21.5
60-80	51.0	53.5
80-100	9.5	9.0
100-200	16.0	9.0
Under 200	3.5	1.5
Fineness No.	93.5	85.

Mesh	G 40 Rochester, 30 Lake, 30 Burnt (Calc.)
20-40	2.0
40-60	13.0
60-80	40.0
80-100	7.5
100-200	28.5
Under 200	7.5
Fineness No.	104

Mesh	H Tumbled Burnt Sand	I Washed Tumbled Burnt Sand
20-40	5.5	8.0
40-60	24.0	27.0
60-80	49.5	50.0
80-100	7.5	8.0
100-200	11.0	6.5
Under 200	2.5	0.5
Fineness No.	86 (no cores from this)	81

Mesh	J Tumbled Ignited Sand	K Washed Tumbled Ignited Burnt
20-40	4.5	8.0
40-60	17.0	29.0
60-80	52.0	52.0
80-100	8.0	6.0
100-200	15.0	4.5
Under 200	3.5	0.5
Fineness No.	92	77

Standard 50 Rochester 50 Lake

	L Ignited 2 Hours at 475° C. ("Short Ignited Standard")	M Ignited 2 Hours at 475° C. and Ignited 2 Hours at 550° C. ("Long Ignited Standard")
20-40	3.0	5.0
40-60	18.0	20.0
60-80	38.0	41.5
80-100	9.5	9.0
100-200	22.5	19.5
Under 200	9.0	5.0
Fineness No.	97	95

It is seen that when the burnt sand was ignited in a half inch layer, without much stirring, the particles over 60 mesh break up a little, as would be expected from the burning out of the carbon bond, but that when ignited while in motion, as of popping corn, there was, if anything, a slight agglomeration.

Tumbling the burnt sand had no effect.

(To be continued.)

METAL CARRIED BY SOLDIERS.

A table showing that more than 18 pounds of metal enters into the composition of articles required for the equipment of each infantryman has been prepared by the Ordnance Bureau of the War Department. The metal equipment carried by each infantry soldier weighs 294.65 ounces, and an additional weight of 114.7 ounces is added by equipment of cotton, wool, leather, and wood. The Ordnance Bureau, therefore, supplies each soldier with approximately 25 pounds of equipment, this being exclusive of that supplied by the quartermaster corps.

A "memorandum on materials entering into the composition of the articles of equipment of an infantryman furnished by the Ordnance Department, weight in ounces," is as follows:

Bacon can—0.4 ounce iron and steel and 8 ounces tin.

Bayonet scabbard—2 ounces iron and steel, ½ ounce brass, 1 ounce aluminum, 0.3 ounce other metal, 1 ounce cotton, 2 wood, and 0.7 leather.

Canteen—5 ounces aluminum and 1.8 ounces other metal.

Canteen cover—0.2 ounce brass, 3 ounces cotton, and 1.8 ounces wool.

Cartridges (100)—47.4 ounces brass, 36.4 ounces metal in bullet, and 12 ounces explosive.

Cartridge belt—10 ounces brass and 14.1 ounces cotton.

Condiment can—4.35 ounces tin.

Cup—5.5 ounces aluminum and 0.6 ounce other metal.

Fork—1.5 ounces other metal.

Gun sling—1 ounce brass, 7 ounces leather.

Haversack—1.8 ounces brass, 24 ounces cotton.

Knife—1 ounce iron and steel, 0.7 aluminum.

Meat can—0.3 ounce iron and steel, 12 ounces aluminum, 0.1 ounce other metal.

Oiler and thong case—1.5 ounces brass, 1.5 leather.

Pack carrier—0.3 ounce iron and steel, 6 ounces cotton, and 1 leather.

Pouch for first-aid packet—0.3 brass and 1.6 ounces cotton.

Rifle—107 ounces iron and steel and 29 ounces wood.

Shovel—25 ounces iron and steel and 4 ounces wood.

Shovel carriers—5 ounces cotton.

Spoon—1.7 ounces other metal.

An explanatory note says the metal used in the bullet is a lead and tin composition inclosed in a jacket of cupro-nickel.—Official Bulletin.

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CONTENTS

	Page
The Army or Military Bronze Finish	467
Competition of the Incompetent in the Brass Manufacturing Business	468
The Uses of Bronzes in Railroad Turntables and Movable Bridges (Concluded)	469
The Swelling of Zinc Base Die Castings	470
Metal Industry in Germany	471
When Friend Metal Worker Goes Off to War	472
A Few Patent Points With Some Applications to Alloy Patents	474
Chinese Metal Manufactures (Continued)	477
Brass Rolling Mill Alloys	479
An Improved Electro Analysis Apparatus	483
Casting Bearings in Sand and Metal Molds (Continued)	485
Negative Experiments on Waste Core Sand (Continued)	488
Editorial:	
The Patent Situation	490
The Liberty Loan	491
New Books:	
Everyman's Chemistry	491
Lubricating Engineer's Handbook	491
Hendricks' Commercial Register	491
Journal of the American Institute of Metals	491
Shop Problems	492
Patents	494
Equipment:	
Patented Automatic Electric Blocker	496
New Polishing Composition Plant	496
New General Electric Company Products	497
New Metal Stamping Plant	497
Celluloid Zapon Company's Exhibit	498
Wool	498
The Flux and Cleaner Question of Brass	499
Improvements in Crucible Furnaces for Melting Scrap Brass, Etc.	500
Metal Band Saw	500
Associations and Societies	501
Personals	501
Trade News	502
Metal Market Review	508
Metal Prices	509

THE PATENT SITUATION

A paper presented before the September meeting of the American Institute of Metals at Boston, Mass., by William J. Rich on the patent situation in the United States contains so much of vital interest to the metal industries that we publish it in this issue of The Metal Industry.

This paper, "A Few Patent Points With Some Applications to Alloy Patents," gives a clear insight into the conditions surrounding the application for and the granting of a United States patent right.

As Mr. Rich rightly says, the popular conception of the reasons for the existence of the Patent Bureau and the operation of its functions in granting patent rights is not as a rule correct. The fundamental idea of a patent is to improve the state of an art and to encourage persons of an inventive turn of mind to bend their energies to aid in the development of new processes and devices. The Government agrees to give them exclusive rights to such invention for a term of years. The understanding is, however, that after the period of seventeen years, the use of such an invention may become public property. This, as Mr. Rich says, is all right in its way but it does not go far enough.

The chief reason advanced by Mr. Rich for the apparent and real weakness in United States patents is that the remuneration offered by the Patent Office is inadequate to attract and hold talent of such caliber as to insure the soundness of the patents issued. We believe that Mr. Rich has sounded the right key in the matter and conditions could be much bettered were the Patent Office granted larger appropriations by Congress not only to increase the size of the working force, but to increase the salaries of such as become expert in the service and thus retain the value for the department, of this experience that it has paid to get. There is no better use to which the receipts of the Patent Office could be put than to increase the capacity of its service and at the same time strengthen the quality of its product—patent rights.

We believe the time is not far distant when the Patent Office will be able to stand back of its grants and when a patent right is granted the inventors can be assured of all the power of the Government to protect and defend the specifications of that patent right in every line of its reading. This is done in foreign countries and is one reason why foreign patents are usually looked upon by manufacturers as being somewhat stronger than the average United States patent.

With conditions improved along the lines outlined above we believe that the situation regarding patents would be much clarified. The force of examiners would be large enough to enable a thorough search of every ap-

plication so that some of the seeming anomalies now issued would be a thing of the past. For instance, the granting of a class of patents covering a process or device that has been already put to commercial use with the resulting expensive litigation would be impossible. Another form of patent that we hope to see eliminated is the one for a process or device that is not actually workable from an engineering, mechanical, chemical or metallurgical standpoint. In fact we hope to see the day when a person can apply for a United States patent with the assurance that that is what he will get. A clear cut unassailable patent right backed by the Government and not find that he has been given only the right to buy a law suit.

THE LIBERTY LOAN

The second Libetry Loan has been taken up by the citizens of these United States to an amount that will probably exceed the highest limit expected by the Administration at Washington. At this writing we are not able to give total figures either of subscriptions to the loan or of number of subscribers. We know, however, that the amount taken is over $5,000,000,000 and that in the number of persons subscribing to the loan the German Government will find considerable food for thought. A peculiar phase of this second loan that will not add to Germany's pleasure in digesting the news about this loan is that funds belonging to her have helped buy the bonds! Controller of enemy property, ARTHUR WILLIAMS, is to be congratulated for the neat turn he executed when he sold the hoarded copper, nickel and other things belonging to the Germans and invested the money in Liberty Bonds! This may be termed a "Yankee Joke," but in spite of the ironical character of the transaction there is a sound business side to it. The money in the controller's hands could not be invested to better or safer financial advantage nor for a better and nobler purpose: that of making the world safe for democracy. Even though the German owners of the material commandeered and sold may not think so now, they will be of that opinion finally and we have no doubt will thank Mr. WILLIAMS for his thoughtfulness!

THE METAL INDUSTRY extends its congratulation to all of the earnest workers in the metal trades all over the country who contributed so liberally of their time and funds to make the second Liberty Loan the success it has become and bespeaks the same interest and energy for the third, fourth, or fifth Liberty Loans as they may become necessary.

NEW BOOKS

Everyman's Chemistry. By Ellwood Hendrick. Size 5¼ x 8 inches. 374 pages, including index. Numerous diagrams. Bound in boards. Published by Harper & Brothers. Price, $2. For sale by THE METAL INDUSTRY.

The reader is first introduced into General Chemistry with such a wealth of anecdote and good-natured comment that it is well worthy of perusal if only as a pastime. In a little while, nevertheless, the reader finds himself thinking *as chemists think*, which is the primary purpose of the work. From this he is led into Inorganic Chemistry, with observations on the nature and ways of the different elements and their compounds; then follows Organic Chemistry, which includes a short consideration of coal-tar products.

To those who wish they knew something about chemistry, this book opens the door. It does not profess to be a complete treatise and is in no sense a laboratory guide. On the other hand, it does contain so much chemical information, arranged in proper order, and it is so entertaining withal that even the casual reader is bound to gather from it a sense of chemistry.

The author is well known in New York as one who brings an attractive literary style to the discussion of chemical subjects. His daily articles in the New York *Times*, during the week of the Chemical Exposition in September, have aroused general interest in the progress and application of the science among many of those who heretofore declared it to be a closed book to them.

Lubricating Engineer's Handbook. By John Rome Battle. Size, 6½ x 9½ inches. 333 pages, including index, with added memorandum pages. Bound in boards. 114 illustrations. Published by the J. B. Lippincott Company. Price, $4. For sale by THE METAL INDUSTRY.

The data contained in this book has been taken largely from a note book of a mechanical engineer while he was associated with the oil business, and this matter has been supplemented with such descriptions of machinery and apparata and tables as have been deemed of value to the engineering profession. As the author rightly says, all of the supplies used in the operation of power plants and industrial mills, lubricants and their practical application, are the least understood. It is with this idea in view, therefore, that this valuable book has been prepared, and we have no hesitation in saying that it will be found of great help to designers of machinery, operating engineers, owners, general managers, purchasing agents, lubricating oil salesmen and manufacturers of lubricants.

The book is made up of five parts and each part consists of a number of chapters which treat of practically everything that can be said to have any connection whatever with the art and science of overcoming all friction known as lubrication.

Hendricks' Commercial Register for Buyers and Sellers. 26th Edition. Compiled by S. E. Hendricks Company. Size 10 x 18 inches. Bound in Fabrikoid. Prise, $10. For sale by THE METAL INDUSTRY.

The twenty-sixth annual edition of Hendricks' Commercial Register of the United States for Buyers and Sellers has just been issued. This standard publication is especially devoted to the interests of the architectural, contracting, electrical, engineering, hardware, iron, mechanical, mill, mining, quarrying, railroad, steel and kindred industries. Full lists are included of producers, manufacturers, dealers and consumers, listing all products, from the raw material to the finished article, together with the concerns handling these products, from the producer to the consumer. There are 2,209 pages of text matter and the index to trade classifications numbers 151 pages, covering over 50,000 trade references. The list of trade names, brands, titles of identification, etc., numbering 1,212 pages, furnishes ready reference to distinctive products manufactured by concerns listed in the work. The alphabetical section is included for the first time, and contains in one alphabetical list the name, trade description and address of every concern appearing in the book.

Journal of the American Institute of Metals—In accordance with the recent decision of the membership of the American Institute of Metals, the journal, which will take the place of the annual bound volume of transactions, has made its appearance. This first number is classified as Volume XI, Number 1, and is dated June, 1917, and consists of 112 pages and contains the program of the eleventh convention just held at Boston, Mass., the week of September 24 to 28, and also includes six of the papers read and discussed at the various sessions of the Institute. Dr. Paul D. Merica of the Bureau of Standards, Washington, D. C., is the editor. This journal will be published quarterly by the Institute, thus making its appearance in June, September, December and March of each year. The journal will be sent to all active members of the Institute.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR Plating-Chemical

BRAZING

Q.—We have been using for some time brazing pots made of graphite, but their life is very short, averaging from eighty to ninety hours. Our spelter is about 50 per cent. copper and 50 per cent. zinc. The flux, a mixture of borax and boracic acid, and the brazing temperature around 1,550 to 1,600 degrees Fahr. Recently we tried out a steel pot, whether an alloy steel or plain carbon steel, we do not know; at any rate, our brazing was very unsatisfactory. The flux seemed to form a scum on the surface of the spelter, requiring frequent skimming, and blotches of a hard black substance formed over the work we were brazing, while the brazed surfaces occurred also in irregular blotches.

As it is claimed that the steel pots outlive the graphite, we would like to know how this difficulty can be overcome.

A.—The iron from your steel pot is dissolving in the molten spelter, making it drossy and sluggish, giving the unsatisfactory brazing results and causing the hard black substance which is due to the oxidation of the iron. It is likely that your brazing temperature is much higher than you think it is, and by lowering it your pots will last longer. The melting point of the 50 per cent. copper and 50 per cent. zinc brazing solder is 1,596 degrees Fahr., and you certainly run your pot considerably above the melting point of the spelter. The use of a pyrometer in controlling this work is suggested.

Even if you hold your brazing temperature at the lowest point that is practicable, it is doubtful that a steel pot can be used. A number of firms are now successfully using pots of white malleable cast iron for lead at temperatures about the same as those you mention. These pots are cheap and can be made heavy and substantial. Any steel or iron pot will, however, soon contaminate your spelter with iron, and the writer very much prefers the graphite pots. A new type of induction electric furnace is now being developed that generates the heat in the metal itself, and it should be ideal for your brazing work, as a graphite crucible could be used, its life would be long and it would be convenient to work about.—J. L. J. Problem 2,501.

CASTING

Q.—We have been experiencing considerable trouble in making cast brass tubes (manganese bronze). We can not make a solid casting. We have cast these on end, flawing them up with a heavy riser head, also flat and feed them. The size of this bar is 12 inches long, 2¼ inches outside diameter and 1⅜ inches, core.

The following are the two different manganese bronze formulas that we have tried:

	First		Second	
Copper	62	pounds	56	pounds
Zinc	37	pounds	38½	pounds
Tin	1	pound	0	
Aluminum	7½	ounces	½	pound
Ferro-manganese	6	ounces	0	
17 per cent. manganese copper..	0		5	pounds

What we require is a solid cast tube, free from all flaws. What mixture should we use to give us the same tensile strength as our present mixture, how should we mix it and at what heat should the metal be poured?

A.—The first mixture you mention is a forging mixture and the second is intended for sand castings. Presumably you are using the second mixture and as you intimate that the tensile strength is satisfactory when you obtain a sound casting, there seems to be no reason for changing the formula.

If your manganese bronze is of good quality, carefully melted under a cover of charcoal, no trouble should be had in obtaining sound castings when casting flat without any riser at all as the pattern is of uniform cross-section. Set the pouring gate and skim gate at one end of a flask containing two castings and carry a runner to the opposite end and hence to the two castings so as to skim out any dross. By making the pouring gate above 15 inches high a good pressure will be obtained and the gases driven off more effectually. Manganese bronze can be fed by chills very satisfactorily and if the casting had thicker walls you could cast it successfully in an iron mold using a dry sand core. However, the high pouring gate and long runner recommended above should give you sound castings, pouring at a fair temperature.—J. L. J. Problem 2,502.

FINISHING

Q.—We wish to obtain a formula for a brass solution which will have a green-like finish similar to 18 karat gold and which can finally be finished by scratch brushing and lacquering.

A.—It is somewhat difficult to regulate a brass solution so that a greenish brass is constantly produced to imitate green gold. It would be much easier to first brass plate the articles, then form a green by immersing them afterwards in a solution of sodium hyposulphite and acetate of lead or nitrate of iron. After the green is developed the articles may be brushed if necessary with a fine wire scratch brush and a little pumice stone and water to relieve the green and show the brass beneath in imitation of gold. It also might be advisable to tint the lacquer used with a little gold color.

The formula for a brass solution consists of:

Water	1 gallon
Sodium cyanide	4½ ounces
Copper cyanide	3 ounces
Zinc cyanide	1 ounce
Soda ash	1 ounce
Sal ammoniac	⅓ ounce

Temperature normal, with 3 to 4 volts.

For coloring the brass plate a greenish finish, use the following:

Water	1 gallon
Sodium hyposulphite	8 ounces
Acetate of lead	1 to 3 ounces

Temperature, 180 degrees;

or

Water	1 gallon
Hyposulphite of soda	8 ounces
Nitrate of iron	2 ounces

Temperature, 180 degrees. C. H. P.
Problem 2,503.

HARDENING

Q.—Can you suggest what metal to add to German silver (18 per cent.) to make it stiffer and more steel-like without raising the nickel content? These German silver articles are used for spurs.

A.—We would suggest that you use 6 ounces of 30 per cent. manganese copper to the 100 pounds of nickel silver, which will go a long way to harden and stiffen the metal.—K. Problem 2,504.

MELTING

Q.—We have been using for the past year an oil operated melting furnace for melting yellow brass and red metal castings. Recently we have had trouble with the furnace consuming a great deal more oil as compared to the amount it previously required

for melting the same amount of metal per day. Can you tell us what the trouble is? Also can you inform us of a method of testing our fuel oil?

A.—In order to secure a good and uniform grade of fuel oil, it is absolutely necessary that you purchase it on specifications. An oil containing a large per cent. of paraffin has a higher heating value than an oil with little or no paraffin. The amount of paraffin can be determined by subjecting it to the cold test. An easy and simple way of making this test is to place a small amount of the oil on a piece of ice. The oil, if it contains paraffin, will congeal at once.

The presence of water in the oil will show by flaring back when in use. This interrupts the combustion and causes the air to be blown on the molten metal in the furnace, also causing dirty oxidized metal and bad castings. While the use of a heavy fuel oil containing considerable paraffin is desirable it is also necessary that it should be stored in tanks that are kept at the correct temperature, say, about 65 degrees Fahr.—P. W. B. Problem 2,505.

MIXING

Q.—Would you kindly advise me what you consider the best information published on how to mix britannia metals and coffin hardware, also give instructions how to re-mix scrap, dross, etc.

A.—Britannia metal and similar alloys are generally mixed in iron kettles. Where copper is added the writer prefers to use a hardener or rich alloy consisting of copper 20 and tin 80. This, of course, would be prepared in a crucible and cast into small ingots. The hardener and antimony are added in the required amounts to the tin with constant stirring. A method that has been recently advocated for the making of the copper-tin hardener is to melt the tin at a high heat, cover with zinc chloride and push the copper in thin strips down through it so as to avoid oxidation. As a cover for the iron kettle instead of the usual powdered charcoal, coke with a small amount of clay added and the whole ground to a fineness of from 100 to 200 mesh is used by some smelters.

For coffin hardware an alloy of lead 87 and antimony 13 is generally used. The experience of the makers of shrapnel bullets recently has been that this alloy is only made of uniform composition with considerable difficulty, mechanical stirrers in the kettles being found necessary by some in order to meet the required analysis limits. Undoubtedly you should test your alloys for uniformity and no better test is available that the Brinell hardness test. After a standard hardness has been established for each alloy it should not be allowed to be poured into ingots until found to be up to the required hardness figure. Tests for fluidity and toughness may be made by pouring narrow strips and bending same.

If the lead free scraps and dross are kept strictly apart from those that contain lead, you can sweat out the metal; find its analysis and use it up accordingly. Any oxides that remain should be sold to the refiners as they require a high temperature for their reduction and they cannot be handled economically in small amounts.—J L. J. Problem 2,506.

PLATING

Q.—Can sheet zinc 3/16 inch thick be used as an anode for electro zinc plating or galvanizing?

A.—Zinc that is 3/16 inch thick can be used as an anode, but, of course, it will not last as long as zinc of a heavier gauge. It would also be better to take the temper out of it and use if perfectly soft.

The best anode for such purposes would be one of cast zinc containing about 1 per cent. of aluminum.—C. H. P. Problem 2.507.

POLISHING

Q.—We are contemplating making alterations in our polishing department, which consists of several small high speed spindles for finishing jewelry. At present our equipment is driven from a line shaft located near the floor under the bench to the lathe located on the bench.

We find that with the proposed alterations a line shaft located near the ceiling and belting, down to the lathes located on the bench, will give us a better layout. However, we have noted that most invariably polishing lathes are driven from below the bench, and we would like to know if there is any technical or practical reason for it.

A.—As speed of rotation is the important factor in polishing or buffing operations, it makes very little difference what method is used for driving purposes. The downward drive has an advantage that the pull or stress is upon the lathe bearing and not upon the cap or cover of the bearing. Another advantage is that the belt is more out of the way.

In many operations of polishing the belt from overhead countershafts would be in the way of the objects being polished, especially long pieces. Another factor is that of safety, as a downward driving belt is less liable to cause accidents to the operator. These are the only technical and practical reasons in favor of the downward driven polishing lathe.—C. H. P. Problem 2,508.

TINNING

Q.—We are producing a metal screen from .003 inch thick by ½ inch wide material, which is bound together at the intersecting points through subjection to sufficient heat to fuse a coating of tin, which we deposit on each strip and which increases the thickness of the strip about 1/1,000 of an inch. We find that after tinning the strips that we get a very bright clean surface which finish is destroyed after subjection to the fusing heat. In fact, after this binding or welding operation, the screens turn almost black. The size of the screen varies from the area of one square foot to about one-fourth of one square foot.

We desire a tin or other metal that will not discolor or oxidize when subjected to such welding. As the screen is a commercial proposition, we do not believe we could afford any precious metal.

A.—You do not state whether the material used is brass or steel. Presumably the coating of tin you deposit is put on electrolytically. If so, the coating may be very much thinner than 1/1,000 of an inch. Electrolytic coatings are not alloyed to the metal on which they are deposited or indeed very firmly adherent. Hence when such a coating is heated it may blister or, if very thin, fuse into small globules, leaving the steel or brass surface exposed so that it will oxidize and turn black.

It would seem that the articles you mention could be formed from ordinary tin plate and then coated with a solution of rosin dissolved in alcohol. This solution is a good flux for tin and will allow a satisfactory job of soldering to be done many months after the forming operation, whereas if a tinned surface is not protected in some such way (especially in the case of copper) it becomes black and a good job of soldering cannot be done unless the tin is removed mechanically and the article retinned.

By dipping the rosin-coated stampings into molten tin they ought to come out bright and be soldered together. If the material used is copper or brass and only .003 inch thick, it could not be left in the molten tin very long, especially if the tin were very hot.—J. L. J. Problem 2,509.

WEIGHING

Q.—Will you please advise me of a formula for estimating weights of copper commutator bars and segments?

A.—No special formula is used in estimating the weights of copper commutator bars and segments. The maximum and minimum thickness is added together and divided by two in order to get the average thickness. This figure is multiplied by the width and then by the length, which gives the cubic contents in inches. Multiply this by 0.32, which is the weight in pounds of a cubic inch of copper.

When there is a marked radius on a bar, allowance should be made for it in the calculation; for instance, if there is a quarter inch radius, deduct one-eighth inch from the width. When dies become old there may be a slight concavity at the middle of the bar, but this can be disregarded. There is also a difference in density of the copper in the center of a large bar and that at the surface as the surface is densified to a slightly greater extent in the drawing operation.

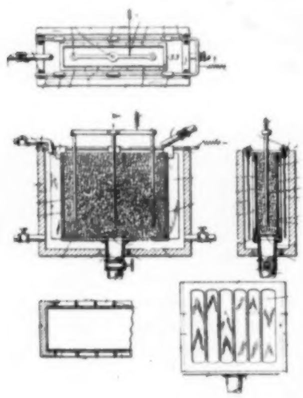
It is customary to weigh small commutator segments rather than to calculate their weight. A half a dozen or more should be weighed and the average weight taken, as the individual segments may vary somewhat.—J. L. J. Problem 2,510.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,239,443. September 11, 1917. **Apparatus for Electrolytic Deposition.** Frank L. Antisell, Perth Amboy, N. J.

This invention relates to anodes for plating out metals from solutions, for instance, copper that has been dissolved in excess of that plated out at the cathode of an electrolytic copper refinery vat, or that which has been leached out of its ore.

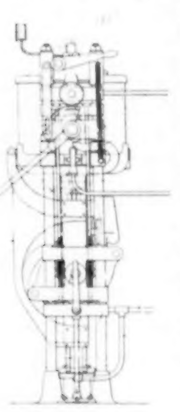


The patent covers:

An anode, as shown in cut, consisting of a container open at one end for the passage of the fragments of conducting material and the solution formed with a bottom constructed to support the fragments of conducting material and permit the circulation of solution therethrough, closed ends and open sides, supporting rods connected to said sides, sheets of veneer within the container and supported by the sides and said rods, a conducting member extending into the container to form a wet contact, and fragments of conducting material within the container and surrounding said conducting member, means for causing a circulation of the solution through the anode.

1,239,807. September 11, 1917. **Die Casting Machine.** Albert W. Morris, of Springfield, Massachusetts, assignor to Morris Process of New York, Incorporated, of New York, N. Y.

This invention relates to the means employed for heating the melting pot, for governing the admission of air under pressure thereto, for opening and closing the discharge nozzle of the melting pot, for closing and separating the parts of the mold, for inserting and withdrawing the cores, for ejecting the casting from the mold, and for maintaining close contact between the melting pot and mold during the casting operation. The means are such as to prevent removal of the mold from the casting position until the discharge nozzle of the melting pot has been first closed, and said means are by preference so disposed that they can be readily operated by a single attendant standing in front of the machine.



The patent covers:

In a machine, shown in cut, for casting metal under pressure, the combination of a melting pot, a mold for receiving the molten metal from said pot, a mold-carrying frame mounted so as to swing upon an axis transverse to the axis of the discharge nozzle, a fluid actuated jack having a longitudinally moving plunger for pressing the mold-carrying frame toward the melting pot when the mold is in casting position, and valve-controlled means for actuating said jack.

1,239,465. September 11, 1917. **Composition of Matter.** William A. Day, Bellingham, Washington.

This composition consists of the following ingredients, combined in the proportions stated, viz:

Lead	5 pounds.
Tin	5 pounds.
Zinc	1 pound.

That is, said metals are combined in the proportion of one part of zinc, five parts of tin and five parts of lead. These metals are melted and thoroughly mixed together while in a molten condition and then molded in bars suited for use as solder. This alloy, has been found to be very useful in soldering cast iron, mild steel, aluminum, pot-metal and lead. To prepare cast iron or mild steel for joining with this solder the surfaces to be soldered are made clean and bright and then covered with a flux composed of the following ingredients: three parts table salt (sodium chlorid), seven parts water, and seven parts muriatic acid (commercial hydrochloric acid. To prepare aluminum, lead and pot metal, the surfaces to be soldered are made clean and bright but no flux is applied. If the parts to be joined are massive, their temperature is raised to about 200 degrees F. Then the solder is applied with a hot soldering iron (copper).

1,240,395. September 18, 1917. **Composition for Protecting Surfaces from Corrosion.** D. C. Westerfield, Dayton, and E. J. Rogers, Miamisburg, Ohio.

The principal object of this invention is to provide a new and useful composition of matter for the purpose of effectively cleaning metals at minimum cost. The cleaning composition will not only thoroughly clean the metal subjected to its treatment, but in addition is adapted to efficiently remove rust from it before, and prevent the corrosion thereof after, paint has been applied.

While the new cleaning composition is applicable to all metals, it is particularly adapted for treating iron and steel which consittute the principal materials of which automobile bodies are made. It is extremely important that these bodies be cleaned and made corrosion proof by a composition or compound that can be cheaply made up and which at the same time possesses properties that are effective for the purposes to be accomplished. Likewise it is desirable that the composition be made up in such form that it can be put on the bodies by unskilled labor, to the end that the cost of its application may be reduced to the minimum.

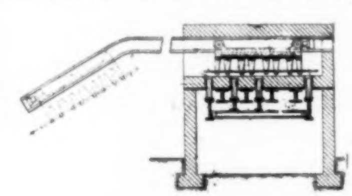
Commercially the composition is made up as follows:

Acetone (by volume), 25%; orthophosphoric acid, 85% solution (by weight), 24.1%; shellac (by weight), 5%; and water, 50.4%, or a quantity thereof sufficient to make the composition 100% by volume.

After the metal has been treated with the above composition and wiped dry, it will present a thoroughly clean surface to the paint, which may then be applied without fear of rust forming under it.

1,241,526. October 2, 1917. **Metal Heating Furnace.** Z. B. Leonard, Cleveland, Ohio.

The invention comprises a heating furnace, as shown in cut, embodying means to convey numerous strips of metal collectively or in batches through the heating chamber thereof, including a device to deliver the strips in definitely assembled relation in batches to said conveying means, and also a device to remove and carry away each batch of strips subsequent to the heating operation.

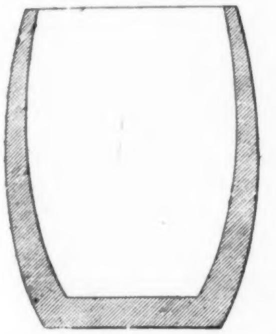


The furnace consists of an elongated brick structure subdivided horizontally by a false bottom to provide chambers and compartments above and below the same. Thus, one end of the furnace has a receiving chamber separated from a central heating chamber, which communicates with a discharge chamber at the opposite end of the furnace, both end chambers being cut off from the heating chamber by depending baffle walls extending into close proximity to bottom, but with sufficient space there-between to permit the passage of the

material into and out of the chamber. A number of gas or oil burners are arranged at intervals at one side of the furnace to furnish the desired heat for heating the material which is caused to travel longitudinally through the chamber.

1,241,971. October 2, 1917. **Melting Pot or Crucible.** John C. Henderson, of Washington, D. C., assignor to Driver Harris Company, of Harrison, N. J., a corporation of New Jersey.

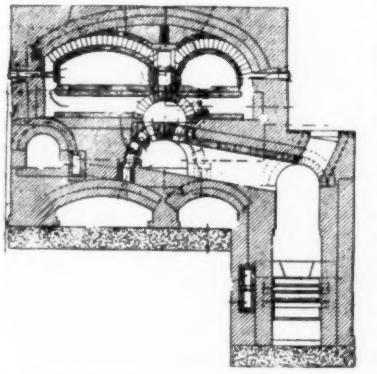
This invention relates to melting pots or crucibles, as shown in cut, for melting metallic substances of high melting point, such as brass, copper and the like, and has for its object to provide a commercially practicable cast metallic melting pot or crucible for use in the manufacturing arts for melting copper, brass and the like in quantities such as are now melted in graphite crucibles. It further has for its object to provide such a melting pot or crucible in which the time and fuel required for melting substances of high melting point is reduced largely below that required in present practice. It further has for its object to produce such melting pots or crucibles which shall not be liable to break when hit or handled and may be repeatedly used many times.



In practice in making a crucible involving this invention the inventor casts the same from an alloy containing from five (5) to thirty (30 per cent of chromium and fifty (50) to ninety (90) per cent of nickel. The combined chromium and nickel preferably amounts to sixty (60) per cent. The preferred alloy contains chromium twelve (12) per cent, nickel sixty (60) per cent iron twenty-six (26) per cent and manganese one and one-half (1½) per cent. Cobalt can be substituted for nickel, being of substantially the same character. Cobalt is associated with iron in Mendeleef's table and is substantially the same atomic weight. Good results can be obtained if the iron content above referred to is omitted.

1,241,750. October 2, 1917. **Furnace for Annealing Metals.** Richard Masters, Dudley, England.

This invention has reference to furnaces for close annealing metals and particularly for close annealing copper and other metals in the form of wire rods, sheets, strips and the like, the said furnaces being of that type, as shown in cut, which have one or more retorts furnished with downwardly projecting inclined mouths at each end sealed by dipping into water contained in tanks, the articles to be annealed being passed through the water seals and the retorts by means of a continuous endless chain conveyer, which travels upon rollers outside the furnace and back along the return tunnels in the bottom of the same.



The objects of this invention are to construct a fire-brick furnace in combination with a continuous conveyer, which firstly shall effect in working a considerable economy in the fuel required for heating the metal.

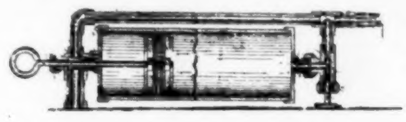
Secondly, to enable the heat of the retort or retorts to be regulated and controlled throughout the length, as may be required to give the best results; thirdly, to combine with the furnace the gas producer, which is employed for heating retorts so that the whole of the furnace will be self-contained.

1,241,551. October 2, 1917. **Spraying Apparatus.** D. E. preston and H. E. Prisee, Dayton, Ohio.

This invention relates to certain defined improvements in spraying apparatus for use in floral culture. The object of the invention is to produce a convenient spraying apparatus for spraying plants, flowers, etc., in hot-houses with an insecticide solution and one that can be easily and conveniently manipulated.

The patent covers:

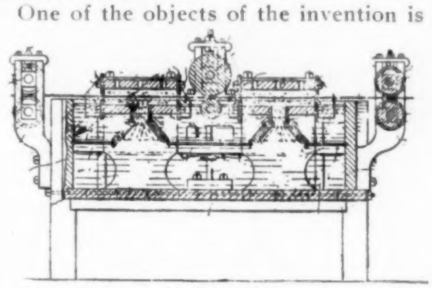
A spraying apparatus, shown in cut, comprising a container adapted to hold a spraying solution, a piston in said container adapted to act upon said solution to cause its discharge from one end of said container, a rod extending from said piston and affording means for restoring the piston to the normal position, a chambered member mounted on the cover of said container and through which said piston rod extends, said chambered member communicating with the upper end of the container and having oppositely disposed lateral pipe-connecting apertures, an inlet pipe connected with one of said lateral apertures and through which water under pressure is discharged to said chambered member and thence to the upper portion of the container.



1,242,695. October 9, 1917. **Method of and Apparatus for Electroplating Wire Cloth.** Ralph O. Hood, of Danvers, Mass., assignor to Clinton Wire Cloth Company, of Boston, Mass., a corporation of Massachusetts.

This invention has relation to electroplating elongated materials, such as wires, perforated sheets, wire cloth or netting and the like.

One of the objects of the invention is to provide a method and apparatus which may be employed for electroplating wire and wire cloth of different sizes from fine screens to cloths or fabrics made of thick wires or rods, which are bent only with great difficulty.



According to the invention the article to be plated, whether it be a wire, a fabric or a perforated plate, is caused to travel in a straight line or plane through the electrolyte in proper relation to the anodes, and hence the objectionable bending thereof is obviated.

In the particular apparatus illustrated the article is caused to travel horizontally above the normal level of a body of electrolyte between, or in the presence of, anodes of suitable construction, and the electrolyte, by suitable means, is raised so as to flood the article and make proper contact with the anode or anodes.

1,244,414. October 23, 1917. **Process of Coating Iron, Steel or Other Metals with Metal.** Ernst Bernheim, of Dusseldorf, Germany, assignor of one-half to Charles F. Burgess, of Madison, Wis., and one-half to C. J. Kirk, of New Castle, Pa.

This invention refers to an improvement of the processes of coating iron, steel or other metals with zinc, copper or the like by covering the metals to be coated with the coating material or its alloys in comminuted form and applying heat thereto.

The purpose of the invention is to improve the color of the resultant product as well as to reduce as far as possible the time now required with these processes for heating as well as for cooling off, and to thus make the entire process more economical. The invention consists in the use of added materials of good heat conductivity instead of, or together with, the added materials heretofore used. As such materials may be used metals or alloys of metals, such as aluminum, or alloys of same, or magnesium, nickel, or alloys of same, individually or combined, all in comminuted form.

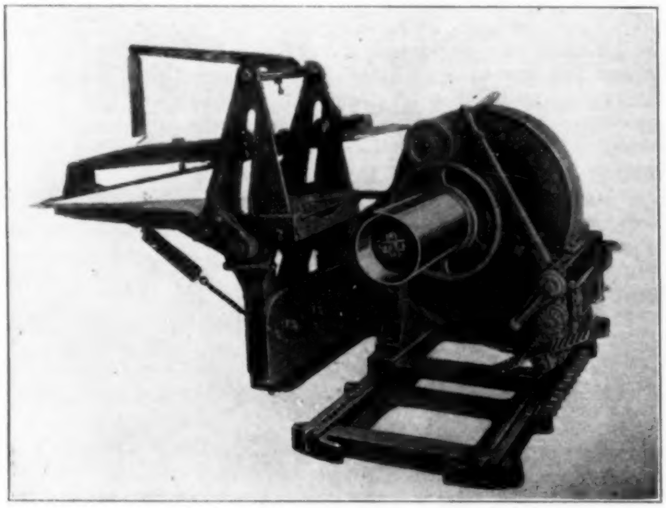
EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

PATENTED AUTOMATIC ELECTRIC BLOCKER

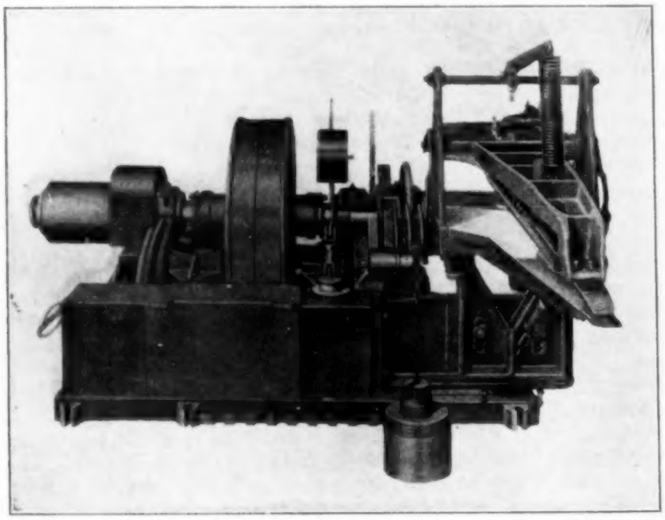
The machine shown in the cuts is claimed by the manufacturers, the Torrington Manufacturing Company, Torrington, Conn., to be one of the most revolutionary types for the winding of sheet metal that has appeared on the market for some years.

It is claimed by the company that practically all of the dis-



AUTOMATIC ELECTRIC BLOCKER

advantages attendant upon all types of blockers previously in use have been eliminated in this machine, and for the purpose of acquainting our readers with the operations of this new blocker we give below the instruction that is given to the operator by the manufacturer and also reproduce their description of how the machine operates.



MOTOR-CONNECTED AUTOMATIC ELECTRIC BLOCKER

WHAT THE OPERATOR DOES.

With one hand turns hand-wheel, bringing lip of winding drum into receiving position. Simultaneously with other hand, pulls hand-lever which lowers the upper guide table and advances the extension of lower guide table. Waits until strip is fully reeled up, steps on treadle which throws out the motor switch, removes coil and proceeds as before.

HOW THE MACHINE OPERATES.

When strip of metal passes through rolls it is carried between chisels, through upper and lower guide tables, under an electric strip contactor, and into the open lip of the winding drum. The strip contactor energizes a battery circuit (9 dry cells) which closes a switch operating the two solenoids. One solenoid releases strip on counterweight which drops into lower position, thereby raising the upper guide table vertically from winding drum, and withdrawing the extension of lower guide table horizontally from winding drum. The other solenoid acts on a rod longitudinally through hollow blocker shaft, operating a toggle joint and expanding inner sleeve against winding drum. This firmly clasps the end of the metal strip, and the friction action starts the winding drum immediately revolving with the inner sleeve. The metal is now passing direct from the rolls to the winding block and automatically closes the lip as it is reeled up on the block.

When the last of the metal strip passes the strip contactor the toggle automatically closes, releasing the front end of the strip. The winding drum collapses inward. The operaor, depressing treadle switch to stop motor, removes the coil, snapping a band over it in the usual manner. The slippage for regulating tension is provided by an oil clutch which affords a quick adjustment by an adjusting valve with star handle.

Although electric, the blocker is simply wired, and the entire control is through one wire from the strip contactor; the motor is started automatically when operator pulls hand-lever to set guide table, and stops when operator steps on foot treadle.

NEW POLISHING COMPOSITION PLANT

An event of interest to all metal goods manufacturers and of particular importance to the trade in the Middle and Far West is the opening of a new plant at Chicago by The George Zucker Company of Newark, N. J., for the manufacture of their "Acme Brand" compositions. The new factory has been established to meet the growing demands in the West for these products and to enable the company to give its Western customers better and prompter service than has been possible from their Newark, N. J., factory.

Henry L. Zucker, the president of the company and a son of George Zucker, the founder of the business, has for over thirty years given his attention exclusively to the development of "Acme Brand" compositions to such good effect that an international reputation has been established for these products.

The George Zucker Company was established in 1863. Rouge was the first product specialized in and by producing a high quality, such a good reputation was established in the jewelry and silver trade that when the manufacture of other products was begun they met with a favorable reception and success. As other abrasive materials, such as tripoli, lime, crocus and the like came into general use, The George Zucker Company broadened its scope and completed its line of polishing and buffing compounds. The success of the company as exemplified by the establishment of the new manufacturing plant at Chicago is considered by Mr. Zucker to be due to the company's policy of always trying to look at the subject of buffing and polishing compositions from the customer's point of view, and of furnishing for the customer the exact kind of material best adapted to his needs, and to exercising personal supervision in selecting and grading raw materials and blending the fats and abrasives to secure the proper and a uniform consistency.

The new Chicago plant is now in operation under the management of Robert C. Fenner, treasurer of the company.

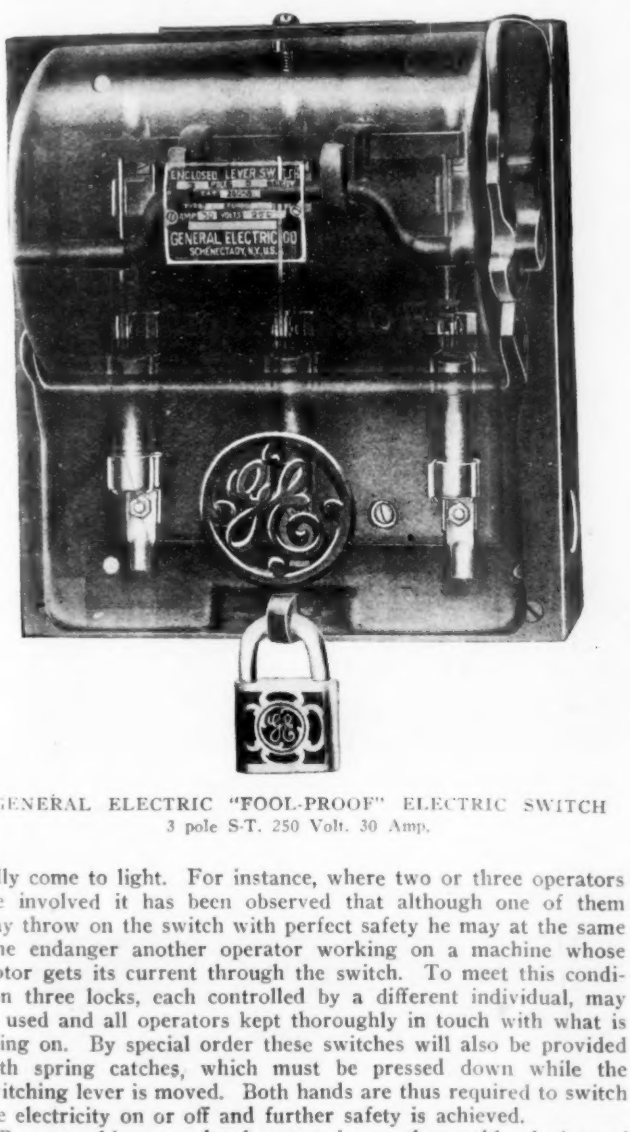
NEW GENERAL ELECTRIC CO. PRODUCTS

A SAFETY-FIRST SWITCH THAT IS FOOL-PROOF.

A year or so ago when the General Electric Company, of Schenectady, N. Y., first marketed lever switches enclosed in safety-first iron casings, the pulse of the electrical world responded to the protective advantage offered; orders exceeded expectations; the success of the product was assured. The designing engineers, however, did not neglect experimentation which might better both the performance and purpose of the switch. Now they have placed in production another type which is considered fool-proof.

The accompanying illustration of the new switch shows not only the exterior protective casing, which is of sheet metal, but also reproduces in phantom the working parts and the slate base. It is easy to see that the padlock at the bottom prevents "outsiders" from "bothering" with the fuses in the lower part of the switchbox. If the hinged casing is also carefully observed it will be evident that the switching lever at the upper right hand side cannot be closed while the covering over the fuses is open and vice versa.

It was at first thought that this interlocking arrangement would give sufficient protection, but several new conditions have gradually come to light. For instance, where two or three operators are involved it has been observed that although one of them may throw on the switch with perfect safety he may at the same time endanger another operator working on a machine whose motor gets its current through the switch. To meet this condition three locks, each controlled by a different individual, may be used and all operators kept thoroughly in touch with what is going on. By special order these switches will also be provided with spring catches, which must be pressed down while the switching lever is moved. Both hands are thus required to switch the electricity on or off and further safety is achieved.



GENERAL ELECTRIC "FOOL-PROOF" ELECTRIC SWITCH
3 pole S-T. 250 Volt. 30 Amp.

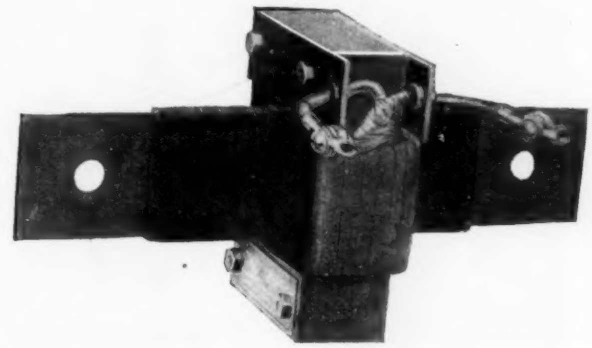
Because this new development is so thoroughly fool-proof modern practice makes its use very advisable wherever "front connected" knife switches are required.

CHEAPER PROTECTION FOR ELECTRICAL DEVICES.

Suppose something—a short circuit for instance—should take place on the power line in your locality, and the machines in the station which send you current should happen to be unprotected. Serious damage would almost certainly result—lights might be out for hours rather than minutes—fans, motors, heating devices and vacuum cleaners would cease their operation.

But of course this rarely happens, for protection is usually adequate. Circuits are safeguarded automatically by electrically-operated devices which, opening under unusual stress, cut off the circuit at a sign of danger.

As a rule, these automatic devices receive the power which causes them to open the circuit from "current transformers," which change the current from a large to a small quantity and keep the dangerous "voltage" or high pressure away from the automatic devices. The transformers also assist measuring instruments in their duties as indicators and recorders of the current or power on the line. When thus used the "transformers" must possess high accuracy and hence are quite expensive.



GENERAL ELECTRIC "TRIPPING TRANSFORMER" FOR PROTECTING ELECTRIC CIRCUITS

Today, if measuring and recording are unnecessary, as is true in many cases, a small "tripping transformer" (see illustration), designed recently by the General Electric Company, of Schenectady, N. Y., may be used in connection with the automatic device.

This eliminates the higher price of the more accurate transformer, and since the new device is accurate enough for tripping purposes it offers a similar advantage; that is, it results in a simpler, cheaper and safer arrangement.

Although small and inexpensive, the new "invention" offers a convenient and very satisfactory method of safeguarding valuable apparatus.

NEW PLANT

As mentioned in the October issue of THE METAL INDUSTRY, the Standard Stamping Company, manufacturers of hardware specialties and stamped metal goods, has moved its factory and offices from Marysville, Ohio, to Huntington, W. Va. As will be seen from the cut, the plant is up to date in every way and is 110 feet wide by 200 feet long and two stories high. The new plant is situated directly in the main line of the Chesapeake & Ohio Railroad. As Huntington is midway between Cincinnati and Pittsburgh and at the very base of gas, coal and mineral supplies, it affords exceptional advantages from a manufacturing and distributing standpoint.

NEW "DAYLIGHT" PLANT OF STANDARD STAMPING COMPANY

CELLULOID ZAPON COMPANY'S EXHIBIT

The consensus of opinion is quite generally to the effect that this year's Chemical Exposition, held at Grand Central Palace, September 24-28, 1917, was a huge success from every angle as an educational enterprise. The public is interested and is intelligent. So it is safe to say that this public will follow with a greater and a more personal interest the future progress of chemistry. Aside from the general public, a great army of users and potential users of everything exhibited were interested in displays shown on the three floors of this mammoth show building. Not the least of all these exhibits, albeit the display was modest, was the booth of the Celluloid Zapon Company, New York, and Stamford, Conn., manufacturers of lacquers and lacquer enamels. A series of most beautiful and artistic finishes on metals, wood, fiber, celluloid and many other materials was the center of attraction and caused lively comment from the many visitors who thronged this booth during the afternoon and evening each day.

One of the most striking of all the exhibits in this attractive collection was a series of glass jars containing raw and finished products of this company, which were re-exhibited this year exactly as shown last year. They showed no deterioration whatever, thus demonstrating the careful attention given to their selection.

CELLULOID ZAPON COMPANY'S BOOTH AT CHEMICAL INDUSTRY EXPOSITION, GRAND CENTRAL PALACE, N. Y., SEPTEMBER 24-28, 1917.

WOOL

Some reasons for the recent advance in the price of felt wheels, such as are used in the polishing of metal goods, are given in some information furnished by the Foot Manufacturing Company, Jersey City, N. J. E. R. Murphey, president of the company, states that wool from which felt wheels are made is, at this time, particularly scarce and high in price for several reasons.

Chief among these is the fact that the United States, since the declaration of a state of war with Germany, has become an absolutely new customer in the market and has bought a number of millions of pounds of wool. The ocean freights are four or five times greater than they have been in the past and the difficulty in getting any wool at all out of the allied countries has greatly increased. As a matter of fact, Mr. Murphey says, he has known of shipments of wool paid for in Australia which were not released by the British Government until eight months after they had been in the warehouses.

THE ORIGINAL SOURCE OF WOOL

As near as can be estimated the following figures are said to be approximately correct for the first part of this year. There was a stock of wool on hand in the United States on January 1, 1917, of approximately 279,000,000 pounds. The United States clip was estimated to be about 275,000,000 pounds. Imports, if they were received and this is extremely doubtful, would be about 250,000,000 pounds, making a total of 804,000,000 pounds. The estimated army and navy requirements for the year were over 200,000,000 pounds with the civilian requirements of fully 600,000,000, which will give an apparent shortage at the present time.

A very small amount of wool has been received so far and less will be received during the next six months, and there is a very strong possibility that the Government will take even larger quantities from the dealers, especially in view of the further draft.

The situation is so acute that a recent meeting was held at the Waldorf Hotel, called by Mr. A. W. Shaw, at the head of the Government Bureau, and all of the wool users were asked to use as much cotton and other fabrics as is possible. In various parts of the country, societies and committees are being formed, asking people to raise more sheep. The Government is in favor of a high price on wool in order to encourage the raising of sheep. The sheep raisers, also, following the example of the wheat farmers, are holding their wool, anticipating other and still further advances in price.

The above facts all tend to necessitate an advance in the price of felt wheels in order to cover the increased cost of their manufacture. It is also the opinion of experts that wool will be one of the last things to resume former prices when the great leveling process sets in after the war.

THE FLUX AND CLEANER QUESTION OF BRASS

By E. D. Frohman, S. Obermayer Company, Pittsburgh, Pa., Read Before the American Institute of Metals, Boston, Mass., September, 1917.

It is well to see what the definition of a flux is. The Century dictionary says:

"Any substance or mixture used to promote the fusion of metals or mixture used to promote the fusion of metals or minerals, as alkalis, borax or tartar or other saline matter, is called a 'flux.' "

We usually think of flux as something which cleans, cleans out or as if by throwing off. This is what we have thought in non-ferrous metals should be done.

The "Brittanica" says:

"A 'flux' is a substance introduced into the smelting of ores to promote fluidity and to remove objectionable impurities in the form of slag."

The substances in commonest use are lime or limestone to slag off silica and silicates; fluor spar for lead. Sodium and potassium carbonates are used for fluxing silicates. Borax is and can be used for fluxing oxides of certain metals. Melting to a clear liquid also grabs up many of the silicates.

Fluor Spar, one of the most common fluxes used in brass foundry practice, although seldom used by itself, is generally mixed with glass, limestone and other adulterants. As stated previously, its great affinity for silicates, its formula being $Ca\ Fl_2$, when used in a crucible the fluor spar attacks the silicates of the crucible, setting free fluorine which attacks the carbon or graphite and then acts on the oxides by bringing them to the surface.

My experiments have so far been in the direction of showing that most fluxes bring oxides of metals to the surface of metals. Up to the present time have found no satisfactory method of determining Cu O Copper Oxide in the metals themselves.

Our experiments have been on the basis of treating in a crucible ten pounds of turnings to each melt, treating with the amount of flux desired by the manufacturer and determining the amount of copper oxide in the slag, redeeming the free copper by means of washing and weighing, so if these experiments are not right, I am certainly agreeable for further suggestions which will have attention.

Samples: No. 1	No. 2	No. 3	No. 4	Rillton Brass Cleaner
9 lbs. 13¾	9 lbs. 13½	9 lbs. 12½	9 lbs. 13	"R.B.C."
2½ oz. loss*	2½ oz. loss*	3½ oz. loss*	3 oz. loss	1 oz. loss
Copper Oxide	Copper Oxide	Copper Oxide	Copper Oxide	Copper Oxide
2.30	1.29	.95	.74	.60

Lime is used in a blast furnace or in a cupola to flux silicates of the ore or to take up the silicates of the pig. In the matter of use of fluxes in melting non-ferrous metals, there is little scientific reason for their use. Go over the entire literature of brass foundry practice and you will find very little on the subject. To go into the analysis of most of the fluxes on the market would be saying, examine fluor spar, lime, borax and you will have their most essential component parts.

To my mind, the use of such materials in brass are wrong and we have patented a product as a reducing agent for brass foundry practice. Several years ago an article was read before this association, showing that charcoal should be used in all melting of brass. Up to the time of flame furnaces, such as Monarch, Schwartz, Hausfeld and others, the gentleman reading this paper was certainly right. He did not go into the chemical reasoning, but said the why's and wherefore's. Charcoal on top of crucibles produces a reducing atmosphere and it is carbon monoxide which certainly reduces the oxides to metals. In many cases, however, charcoal burns too readily and slower burning material must be used. This we have in the product which we are putting on the market in our Rillton Brass Cleaner, for which we have applied for patents, both on the mixture and the use of the mixture. Our idea was to produce a mixture which would on heating give off carbon mon-oxide. Anyone who is familiar with metallurgy of non-ferrous metals knows that carbon mon-oxide is one of the greatest and cheapest reducing agents. We all know that even ingot copper is covered by a film of copper oxide, and so scrap brass must certainly be. If this copper oxide stays in the brass mixture, the brass is not solid, but porous.

Fluxes will bring this to the surface with globules of copper, but why waste this? Our method is to reduce this oxide to metal itself and only bring to the surface such impurities as iron or oxide combined with silicates that won't reduce.

We have proven in the open flame furnace, where large formations of slag or copper silicates were formed, by the addition of our reducing agent, have recovered a large percentage of brass.

Not long ago, I was called upon by a brass foundry whose melting loss in an open flame furnace was about 5 per cent., and I said I could reduce this to about 2 to 3 per cent. I looked into the furnace and saw large formations of slag. I asked the furnace man to put into the furnace from 2 to 3 pounds of our cleaner and then weigh in. After melting we found that instead of getting out 500 pounds of metal which we had placed in the furnace, we got out 530 pounds. What we simply did was to reduce the silicates of non-ferrous metals of the slag to metals themselves, and having a reducing atmosphere, prevented further oxidation. The experiments have proven that a reducing agent is necessary.

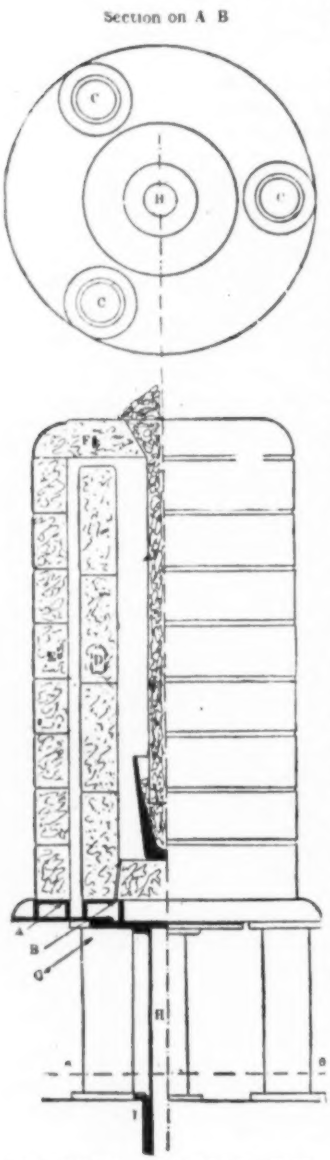
Our attention was first called to this material by one of our friends having trouble with keeping his ladle clean. He used some of this material (which we later improved for the desired effect) to prevent the metal from sticking to the lining of the ladle. This sticking of the metal to the sides of the ladle was not metals themselves, but the oxides, the oxides forming silicates of clay. All this proving that fluxes merely bring oxides to the surface, but a reducing atmosphere is desired.

One of the most interesting patents that has as yet been brought out, and proving my theory of reduction, was taken out for coating aluminum. This party covers aluminum with powdered glass, colored by whatever oxide is wanted to give different colors, Cobalt-oxide-blue, copper oxide-red or green, etc. These mixed with powdered glass and then heated to red hot temperature. We all know aluminum is covered by oxide of aluminum, and the glass melting forms oxides of metal, silicates of aluminum, giving a film which can't be separated from aluminum itself, proving my theory by exact opposite.

*One of the copper compounds used as a reducing agent showed no loss in melting, but drop contained 7½ per cent. copper oxide.

IMPROVEMENTS IN CRUCIBLE FURNACES FOR MELTING SCRAP BRASS, ETC.

Hitherto the efficiency attained in gas-heated melting furnaces for dealing with material of low density, such, for example, as brass scrap, has been very low. The furnace which we illustrate has been designed with a view to improving the efficiency. It consists essentially in arranging the material to be melted in a tube forming the feed column above the crucible, such tube being surrounded by a cylinder venting at the top into another cylinder vented at the bottom. The invention also provides for discharging the melted material by lowering the crucible out of the inner cylinder.



IMPROVED CRUCIBLE FURNACE FOR MELTING SCRAP

Referring to our sectional illustration (Fig. 1), which shows a furnace specially designed for melting brass scrap, it will be seen that the furnace bottom is supported at a height somewhat greater than that of the refractory crucible. The circular platform A is in the form of a hollow or box-like disc, having a central opening B. Upon the platform are two concentric cylindrical shells D, E, the platform being so formed that the annular space between these shells communicates with the hollow interior of the platform, one or more of the columns C forming a connecting passage or passages, as the case may be, from the interior of the platform to the flue or duct. The outer shell is extended somewhat above the inner, and provided with an upper cap or cover F, from which depends the hopper-ended tube G for the reception of the brass scrap. The central opening B in the supporting platform is closed by a cover or disc, supported upon a column H working in a guide J, which, if desired, may take the form of a hydraulic cylinder suitably fitted for raising or lowering the column.

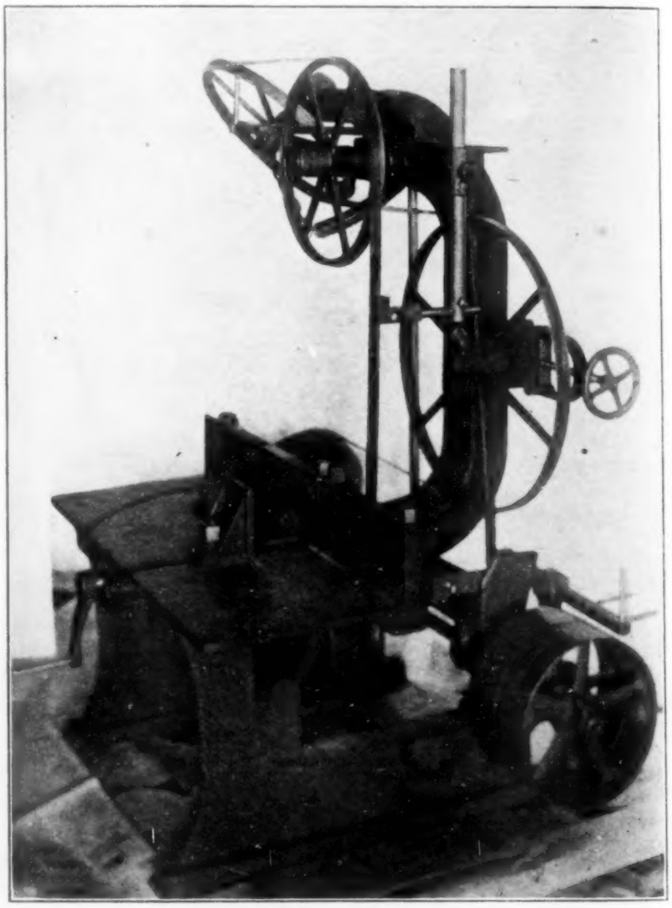
When the crucible is in the position shown, the end of the feeding tube dips about halfway into it. The length of the column of scrap is so proportioned as to be substantially balanced by the head of molten metal between the bottom of the shute and the top of the crucible, thus eliminating the possibility of the metal overflowing.

To empty the crucible or remove the slag and other impurities therefrom, the column carrying the crucible is lowered, care, of course, being taken that the feeding-pipe is empty before operating the column. Provision is also made for carrying on the melting as a practically continuous process, for which purpose a crucible having an outlet at the bottom is provided, supported upon a column having a passageway which allows the removal of a plug from, or its insertion in, the outlet of the crucible. The annular space between the bottom of the crucible and the inner shell of the furnace may then be closed by radially-movable doors, formed so as to fit together and provide a solid bottom to the furnace chamber.

The patentee of the furnace illustrated is Alexander C. Ionides, Porchester Terrace, London, W., and the manufacturers are Complete Gas Combustion, Limited, Vickers House, Broadway, Westminster.

METAL BAND SAW

The band saw shown herewith is manufactured by H. C. Williamson, 321-323 North Crawford avenue, Chicago, Ill. Mr. Williamson states that this band saw, known as No. 2, will cut off any length of stock. The swivel back and vise also allows the cutting of metal at an angle. When starting a cut the operator takes hold of the handle on the top, and in front of the frame, placing saw to the work; it then feeds by gravity, without any further attention of the operator. An automatic stop shuts off the power on the belt-driven machine when through cutting. The spring retards the fall, giving an even pressure all the way down, and the pulleys are flanged and the blade never runs off. The guide can be turned to the right or left to make the blade cut straight.



A NEW METAL BAND SAW

Some of the advantages of this band saw as stated by the manufacturers are as follows: Its continuous cutting allows the saw to run faster than on hack saws. Cuts off tool steel discs, square, eliminating waste due to allowance for running saw. Will cut off any size up to 12-inch "I" beam almost as perfectly as a milling machine could do it. There are no delicate parts to get out of order, and the vise and back can be removed, giving a plain table 14 by 35 inches. The machine will do special cutting that a hack-sawing machine could not do, and the first cost of the machine is much less than a cold saw, which uses an expensive blade requiring continual grinding. It does not require expensive help to operate the machine and it is inexpensive compared to its capacity. If a blade breaks, it can be brazed and used again.

SPECIFICATIONS.

Table 14 x 35 inches and 21 inches high. Floor space 48 x 56 inches. Size of pulley 12 x 3 inches. Speed of pulleys 110 r. p. m. when used for tool steel only. Speed of pulley 150 r. p. m. when used for mild steel. Cuts off one-eighth inch to ten inches round, any length. Cuts off up to twelve inch I beam. Price of machine includes 2 blades. Motor drive attachment extra. One-half h. p. motor 1.150 r. p. m. One inch blades 20 feet 9 inches long. Weight of machine, approximately, 1,000 pounds.

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

AMERICAN ELECTRO-CHEMICAL SOCIETY

This society held its thirty-second general meeting at Pittsburgh, Pa., October 3 to 6, 1917. A large attendance and a most successful meeting is reported. Among the papers read and discussed were the following.

Henry Randall. Hydroelectric Power.

W. H. Coggswell: Trend in Electric Furnace Design.

(15) J. L. McK. Yardley: The Sub-station Problem of the Electrochemical Plant.

Robert Turnbull: Electric Pig Iron in War Time.

(16) R. E. Lowe: A Method of Procedure for the Commercial Analysis of Ferro-silicon.

Frank Thornton, Jr.: A Resistance Furnace.

Haakon Styri: The Electric Furnace in the Development of the Norweigian Iron Industry.

T. F. Baily: Resistance Type Furnace for Melting Brass.

T. D. Yensen: Preparation of Pure Alloys for Magnetic Purposes.

(1) E. D. Campbell: The Influence of the Temperature of Measurement on the Electrical Resistivity and Thermo-Electromotive Potential of Solutes in Steel.

(6) O. L. Kowalke: Calorized Iron as an Element for Thermo-Couples.

W. M. Corse and G. F. Comstock: Copper Castings for Electrical Use.

(8) H. C. P. Weber: Silver Peroxide and the Valence of Silver.

Carl Hering: Suggested Reforms in Some Chemical Terms.

"Symposium on Electrochemical War Supplies."

(11) C. H. Viol and G. D. Kammer: The Application of Radium in Warfare.

(5) W. D. Marshall: Chlorine as a War Factor.

L. B. Cherry: Synthetic Gasoline by Electrochemical Means.

(17) C. W. Hill and G. P. Luckey: The Spectroscopic Determination of Small Amounts of Lead in Copper.

(14) J. L. Jones: The Electrolytic Recovery of Copper and Sulphuric Acid from Copper Mill Pickling Solutions.

(13) I. Coulson: Electrolytic Pickling Process and Its Effect on the Physical Properties of Metals.

O. W. Storey: The Corrosion of Fence Wire.

(12) L. C. Turnock: The Effect of Lithium Hydrate Upon the Capacity of the Edison Storage Battery.

(10) T. S. Fuller: The Prevention of Brittleness in Electroplated Steel Springs.

(7) J. L. Jones: A New Electro Analysis Apparatus.

(2) O. P. Watts and N. D. Whipple: The Corrosion of Metals by Acids.

(9) W. D. Bancroft: The Poisoning of Catalytic Agents.

(4) W. D. Bancroft: Fractional Combustion.

(3) W. D. Bancroft: Theory of Contract Catalysis.

AMERICAN ELECTRO-PLATERS SOCIETY

New York Branch—Meets second and fourth Fridays of each month at 32 Union Square. Thomas Haddow, president, and William Fischer, 300 St. Anns Avenue, New York, sec'y.

The two meetings for the month of October were well attended and the main topics for discussion were zinc plating and rust-proofing. J. Haas, librarian of the New York Branch, who has been called to the colors and is now located at Camp Upton, Long Island, paid a visit to that branch during one of the meetings. Well wishes for his safe return were extended by all members. William Schneider gave an interesting talk on an oxidizing solution and exhibited some samples. Mr. Schneider explained that brass, copper, silver, gold, etc., can be finished in this solution and will be found to stand up very well without the use of lacquer, and will also give a good hard black color.

Members of the branch who expect to exhibit samples of finishes at the next annual banquet, which is to be held February 23, 1918, at the Broadway Central Hotel, New York, are urged to surely have them ready by that date.

PERSONALS

ITEMS OF INDIVIDUAL INTEREST

Frank Hoffman, in charge of the shipping department of the Chase Metal Works, Waterville, Conn., has resigned his position with that company.

Eugene Kelly, assistant secretary of the Syracuse Smelting Works, Brooklyn, N. Y., has taken full charge and management of the Chicago, Ill., office of that company.

S. Herrick, a well-known foreman plater, has become connected with the Celluloid Zapon Company, New York, as their sales representative in the New England territory.

W. A. Bostwick has been elected president of the International Nickel Company, New York, to succeed Ambrose Monel, who resigned recently to enter the Government service. Robert C. Stanley was elected a member of the board of directors to fill the vacancy created by Mr. Monel's resignation.

Frank W. Berry, mill superintendent of the Chase Metal Works, Waterville, Conn., has resigned to accept a position with the National Company, Waterbury, Conn. Mr. Berry has been with the Chase interests for the past twelve years, originally going to them to take charge of their brazed tube department and afterwards transferred to the Waterville plant of which he was given charge.

William O. Renkin, recently chief engineer for A. M. Byers & Company, Pittsburgh, where he had charge of experimental work and the installation of a powdered coal plant on puddling and reheating furnaces, is now connected with the Quigley Furnace Specialties Company, Inc., New York, which is devoted particularly to powdered coal installations. He is manager of the engineering department of the company. He was resident engineer at the time of the organization and construction of the works and town at Sakchi, Bengal, India, for the Tata Iron & Steel Company.

DEATHS

Isaac Gerson, head of the firm of I. Gerson & Sons, Toledo, Ohio, died on October 18, 1917, following prolonged illness from diabetes.

The film of I. Gerson & Sons was established in 1885. Elmer Gerson, son of Isaac Gerson, was admitted into partnership about

1900, and upon his shoulders has for some time rested the active conduct of the large scrap iron and metal business of the firm, which also operates the American Foundry Company, manufacturers of sash weights. I. Gerson & Sons are also substantial stockholders in the Detroit Metal Refining Company, Detroit.

EUGENE F. ROEBER, PH.D.

Dr. Eugene F. Roeber, editor of Metallurgical and Chemical Engineering, New York, died at his residence in East Orange, N. J., Wednesday, October 17, after a lingering illness of several months. Dr. Roeber was widely known in the electrochemical industry of the United States, having been one of the founders of the American Electrochemical Society in 1902, a member of its board of directors from 1902 to 1913, and president in 1913-1914. He also wielded a large influence in this field as editor and founder of Electrochemical Industry, in 1902, and of its successor, Metallurgical Chemical Engineering. Born in Torgau, Germany, October 7, 1867, he was educated at the universities of Jena, Halle and Berlin, receiving the degree of Doctor of Philosophy from the latter institution in 1892. He came to the United States in 1894 and was associated with Dr. Carl Hering in Philadelphia in electrical engineering work. Dr. Roeber was a member of the American Institute of Mining Engineers, American Chemical Society, American Institute of Chemical Engineers, Society of Chemical Industry, American Electrochemical Society, and the Chemists' Club of New York. He was also a member of the committee on papers for the American Institute of Metals for its 1917 convention held in Boston, Mass., September 24-28. He is survived by his wife and three sons.

EUGENE F. ROEBER, PH.D.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

NEW BRITAIN, CONN.

November 5, 1917.

The heretofore tranquil labor situation that has existed in this city for the past several months, with the exception of a strike of short duration at the Skinner Chuck company last summer, has now become more turbulent with a crippling strike of all molders and helpers at the Vulcan Iron Works, the local branch of the Eastern Malleable Iron Works, with other plants at Naugatuck and also at Wilmington, Del. Following a general murmur of dissatisfaction which gradually swept through the entire plant, where about 350 molders are employed, the men decided to strike during the third week of October. Their demands of a substantial wage increase for both molders and helpers, and also a demand for a 10 per cent bonus, fell upon deaf ears when made to General Manager E. G. Hurlburt and a walk-out ensued. Determined not to give in, but being ready and willing to take back the strikers on the old basis of wages, the management has practically closed down the entire plant so that none except foremen and pattern makers are working. Fortunately for the business interests most of the larger and more important orders booked by the Vulcan Iron Works had been cleaned up before the strike, but the concern still has plenty of work on hand. Already a number of customers are taking their patterns from the concern until such times as they will again be able to handle orders.

At all of the other concerns business is very good and there seems to be but little indication of labor unrest. Work is plentiful and wages are better than ever before. The North & Judd Manufacturing Company, which for the past three years has been more or less busily engaged on American and foreign government orders, is still taxed to capacity handling government contracts. The Traut & Hine Manufacturing Company is likewise handling many government orders, among them being enormous calls for army uniform buttons. The P. & F. Corbin division of the American Hardware corporation is likewise engaged in doing considerable government work, but their's is of a more peaceful nature. This plant is making general hardware and finishings for government buildings and ships. The Landers, Frary & Clark Company, however, is probably as busy as any non-munition making concern in the country. Not only are vast quantities of table cutlery, pocket cutlery, domestic articles such as bread mixers, coffee percolators, etc., being turned out, but the concern is also manufacturing army canteens and is also turning out bayonets. Although this plant had added greatly to its factory space during the past year there is every reason to believe that even more space is to be added. Almost an entire block, formerly used for business and residential purposes, owned by this company, has been taken over. The buildings are in some instances being razed and the entire section is being fenced in preparatory to other operations. The Stanley Works, other branches of the American Hardware corporation, the New Britain Machine company, which has again increased its capital stock, and other local industries are all doing an excellent business.

In the line of new buildings, the North & Judd Manufacturing Company is already engaged in constructing a new $40,000 storage house. The New Britain Machine Company is also completing a factory addition which, when occupied, will make this plant one of the biggest machine shops in this section. The Stanley Works also adds new buildings to its plant frequently and also continually adds new property to its holdings with a view to future development.—H. R. J.

PROVIDENCE, R. I.

November 5, 1917.

In the midst of the continued rush of business, abnormally high wages and unprecedented prosperity, there is a general feeling of unrest among the workmen throughout the metal trades. An undercurrent that has suspicious possibilities of grave import seems to keep the situation seething with a threatening outbreak at any moment in an industrial strike. There is no actual grievance of any character, but the operatives appear to be satiated with the one desire of money—money—money.

When the industrial history of Providence is written, tempered by the calm judgment of the future, the enormous amount of wages distributed to the workmen in the various metal lines will be incomparable, in fact unbelievable. It is estimated that for the year 1917 wages will mount in hundreds of thousands above any figure ever before known. And the end is not yet and probably will not be for several years to come. Certainly not until the end of the war and a long time thereafter.

This is the cause. The effect is a business activity that continues especially in the heavier lines. The building lines are perhaps the ones showing the least activity, with the jewelry lines closely following. The greatest problem of the jewelry industry is the obtaining of skilled workmen. It is a peculiar fact that a few months at the jeweler's bench gives the workman an opportunity of acquiring a knowledge and skill with small tools that enable him to obtain good positions as a machinist at big pay. And so large numbers have temporarily drifted into other lines of work and the jewelry shops suffer.

Next to the great rush of business with its incidental labor problems the most interesting feature of the metal trades at the present time is the great response to the operatives to the Liberty Loan issue. The State and city far exceeded the amount that had been allotted to them to subscribe, and in the splendid patriotic showing made the metal trades were well up in the lists of purchasers. At the Gorham Manufacturing Company, $200,000 was taken inclusive of the subscriptions placed by the employes. The corporation and its employes had previously taken $100,000 of the first issue. With more than 400 shops in the manufacturing jewelry, silversmithing and allied and kindred branches, the jewelers' loan committee succeeded in securing an aggregate subscription of more than $1,250,000, which represented about 3,000 individual pledges.

The financial difficulties of the Metal Products Corporation afford one of the interesting topics of the metal trades. Dissension among the officers and stockholders has precipitated a receivership and other litigations and good judgment and shrewd business acumen will be necessary to save this excellent business from going to ruin. The difficulty seems to have arisen through the establishing of other corporations to take over the business of new and specific lines and the using of the Metal Products funds to get the new ventures upon their feet. The Screw Machine Products Corporation from its first inception steadily advanced and was soon beyond the necessity of assistance from the parent corporation, but, according to Arthur C. Stone, for several years president of the Metal Products Corporation, and who is the objecting stockholder to the receivership proceedings, the proposed new telephone company was a discouraging handicap. Injunction proceedings brought by Mr. Stone against his former fellow-officers, George Briggs, Jr., and Harry M. Mays, have been denied by the presiding justice of the Superior Court who stated in his rescript that no evidence of fraud or intent to defraud had been established by the complainant. In the meantime the Metal Products Corporation is being conducted by Henry Fletcher and Joseph P. Burlingame, who were appointed as receivers by the court.

Thomas W. Lind, one of the pioneer manufacturers of jewelers' findings and novelties, died at his home in Greenwood, R. I., last month, in his seventy-second year. Previous to his retirement, about ten years ago, he was for more than a quarter of a century head of the T. W. Lind Company.

The contract has been awarded for an addition on Mill and Bark streets, this city, for the Stillman White Foundry Company, brass founders. It will be of two stories and basement, of brick, mill construction, 26 by 40 feet, and will be used for a storage and shipping room on the first floor and offices on the second floor. There will be a two-story fireproof vault of reinforced concrete, 6 by 15 feet, for the storage of brass and copper.

The Nicholson File Company has recently purchased a tract of land on Kinsley avenue, containing 156,500 square feet of land upon which, it is understood, the concern intends erecting a number of new buildings to afford necessary space to meet the requirements of a rapidly increasing business.

H. J. Astle & Company, of this city, are so busy with an overwhelming number of orders that all of their departments are working on an overtime schedule. During the past month the concern has finished installing a large Boland automatic sand blast and blower system at the Revere Rubber Company, Valley street, this city, and one of the latest Boland polishing and dry dust jewelers, 158 Pine street, this city. A carload shipment of the Boland dry dust collecting system and filtering machine went to collecting systems for Louis Stern & Company, manufacturing the Rochester Company, Rochester, N. Y.—W. H. M.

BOSTON, MASS.

NOVEMBER 5, 1917.

The question uppermost in the minds of business men in the metal industry today is the coal supply, which, in Massachusetts, has reached an alarming shortage. James J. Storrow, state coal administrator, explained to about 100 members of associated industries of Massachusetts exactly how matters stood, with the result that a committee has been appointed and now is conferring with the public safety committee with a view to appearing before Federal authorities at Washington to seek relief. Mr. Storrow pointed out that if New England continues to receive the shipments now being made there would on January 1 be a shortage of 6,285,955 tons of soft coal. This, of course, would be a serious blow to the metal industry. The Government seizure of ocean tugs and other sailing craft had crippled the shipping service and the failure of a manufacturing concern to deliver 50 locomotives has interfered with rail deliveries. Mr. Storrow urges all consignees to unload coal as soon as it is delivered in order that the cars can be kept moving exclusively on coal supply.

War contracts continue to hold the first place in business. Where many of the plants used to deal in thousands or even hundreds, it is no uncommon thing now for a manufacturer to talk of having contracts for hundreds of thousands of dollars' worth of business. But the limit so far has been reached in one separate contract for one million dollars' worth of machine tools for the Fore River yard, or rather for the new shops which are being erected in Quincy. This is the largest contract awarded and presumably will be sublet to several contractors.

Continuing activity in the silverware trade is reported from all sections of the State. Though prices, in most cases, are much higher than last year, representative manufacturers say there is a strong demand for their product which will not be denied.—R. T. E.

ROCHESTER, N. Y.

NOVEMBER 5, 1917.

Business conditions among the metal-using industries of this city have undergone little or no change during the past month, owing to the main fact that the Government has not settled the price of steel as yet. It has been expected that the price for black sheets would be $5,50, which would bring quotations for galvanized at $7@7.50. Jobbers are holding galvanized at $10.

This situation has a marked effect on the use of most of the other metals in Rochester, in a sense, by the larger firms who are busy with orders for the war and navy departments at Washington. Brass is in good demand and deliveries are much better than earlier in the year. This is greatly appreciated by local manufacturers.

Aluminum and spelter have had a heavy falling off in price and are still weak. The market here is well supplied for the present, owing to the fact that a number of shipments of metal that had been delayed earlier in the year are now in the warehouses here. Much of the zinc should have been delivered in this city last winter.

Tin plate is in strong demand, but there is a pronounced shortage in jobbers' hands. Copper is in plenty just now, although holders are not particularly anxious to sell. Lead is very firmly held here. There is some demand for antimony.

All of the metal-using plants in the city are running at top speed at this time, particularly the ones having war orders. The Erdle Manufacturing Company is turning out a large quantity of metal parts for submarines and gun carriages.

Another month should witness even better conditions in the city. purchasing agents agreeing that the metal markets will soon be brought to a war basis and trade matters so adjusted that a perfect understanding will exist all around. The outlook therefore is very cheerful, Rochester metal men feel.—G. B. E.

CLEVELAND, OHIO

NOVEMBER 5, 1917.

Need for aluminum, copper, brass, and the many other materials of the metal industry grows apace with Cleveland's increasing importance in turning out war orders for the Government. Of special significance in this connection is the large amount of material needed now and later for the construction of aeroplanes; some of the largest contracts for which are now being worked upon by Cleveland firms. There are at least a round dozen of these plants in the Cleveland district now working night and day on planes and parts. The Ackerman Wheel Company, with headquarters in the Rockefeller Building, will be a big consumer, as its wheels have been adopted by the Government for aeroplane construction, the construction of these wheels being such as to lessen to a minimum the shock to the machines when descending to earth. The Weger Aeronautical Motor Company is to develop and build the plane motor designed by Charles J. Weger, and equally important will be the part the Liberty motor truck is to play in the conflict in which the United

States is now in earnest. Christian Girl, president of the Standard Parts Company, has been selected to direct the construction of this vehicle. J. G. Utz, chief engineer, has been picked for that position to assist Mr. Girl in the construction of the trucks. It is said at least 40,000 will be built here. Walter Quinlan, of Cleveland, will be superintendent of raw materials.

The Fairmount Tool and Forge Company has established a plant in the east end for the manufacture of parts and tools for aeroplanes. The company has been capitalized at $100,000, and already employs 150 men. Clevelanders are the big men behind this project. The president is J. Wentworth Smith, and with A. H. Homans and H. O. Gibson as principal stockholders. Charles W. Yarham is general manager and B. G. Gilmore sales manager.

The Engel Air Craft Company, recently organized to make aeroplanes and parts, has elected its board of directors. This includes H. D. Baker, president of the concern; A. J. Engel, vice-president and production manager; G. S. Patterson, secretary and treasurer, and other prominent Clevelanders. The company is capitalized at $100,000,000. The capacity for 1918 of its plant at Niles, Ohio, has been sold under contract.

Some of the parts for the Liberty motor for aeroplanes are now being made by the Champion Machine and Forge Company, a $500,000 contract having been placed by the Government.

A touch of humor in these serious war times is appreciated by those close to governmental affairs. When Ernst Wolden, German alien, and once employed on the Waechter und Anzeiger as a reporter, reported this week at the office of U. S. Attorney Wertz, he announced that he was helping to make aeroplane parts at a West Side Cleveland factory, and hoped that when the machines were completed, they would drop a few bombs in the vicinity of the Kaiser and give that worthy fits. Wolden narrowly escaped internment when the owner of the newspaper, Woldemar von Nostitz, was held by local federal authorities.

War plotters are believed to be responsible for an explosion in the factory of the National Acme Manufacturing Company, which is producing machinery to be used in the production of war munitions. Dynamite had been placed under a boiler, but the strength of the boiler plate prevented the explosion having effect, the steel being only dented. Police are looking for two men seen loitering around the plant.

The Cleveland Tractor Company has increased its capital stock from $600,000 to $6,000,000. This increase marks the extension of production of the company, which will be 8,000 tractors a year. This machine is particularly adapted to farming work of the most difficult kind, and a tremendous demand has been created for it since the food shortage has become acute. Rollin H. White, formerly of the White Company, motor cars, developed the present tractor. He is president of the Cleveland Tractor Company. In connection with this extension of plans the company has recently placed a contract with the Weidly Motor Company, Indianapolis, for $3,000,000 worth of engines, 5,000 engines to be delivered the first year, and increasing numbers the second and third years.

The C. F. Mitchell and Sons Company is Cleveland's newest automobile firm. Land worth $52,000 has just been purchased in the East End, and upon this will be erected a $10,000 unit, the first in a group of buildings of fireproof construction.

Awaiting the action of the government on prices the general trend of metals is downward in the Cleveland market. This is so with the exception of copper, on which there is practically no market here, as the large sellers will do nothing until they know just where they stand with the government. There also has been a tendency to discourage buying on the part of consumers on the theory that the price of the metal will be revised upward after the first of the year. Henceforth all deliveries of copper will be limited to four months. The copper committee now forming will have supervision over distribution of supplies.—C. C. C.

COLUMBUS, OHIO

November 5, 1917.

The metal market in central Ohio territory is somewhat unsettled, owing to regulation of prices. Demand is holding up quite well, especially in certain lines, but prices are lower all along the line. There is some question as to the future of the trade in this section, but generally speaking it is believed that there will be a fair demand for all metals during the winter months.

Metal using concerns are buying only for the present and are loath to stock up under present conditions. In fact most of the factories are buying from hand to mouth. Shipments are slow because of railroad congestion and car shortage. Type metals and babbitt are both in excellent demand in all sections.

Lead and spelter are lower and there is a slight falling off in the demand. Brass is moving fairly well, with red scraps selling between 24½ and 25 cents. Yellow scraps are selling at 21½ cents. Copper prices are regulated by the Federal Government. Aluminum is slow and prices are slightly lower. Zinc and other metals are selling fairly well.

The Ohio Metal Company, of Columbus, has just completed the installation of three ingot furnaces for brass. The plant, which is located at Fourth street and Fourth avenue, is one of the most modern in the middle west.

The Simplex Metal Products Company, of Norwalk, Ohio, has been incorporated, with a capital of $10,000, to deal in metals, by Clarence H. Phillips, Walter A. Yeager, Henry A. Pohl, Lenora Camp and Lenora Phillips.—J. W. L.

CINCINNATI, OHIO

November 5, 1917.

The prosperity of the metal trades, as well as the patriotism of the men at the head of the various concerns in the trade, was effectively shown during the campaign for the second Liberty Loan in Cincinnati, closing October 27. All of the branches of the trade in this vicinity have profited generously from the business growing out of the war; and in virtually all cases they have returned a large share of their profits to the Government in the shape of liberal subscription to the Liberty bonds. Some of the largest single subscriptions came from the big machine-tool concerns, blocks of the bonds in lots of $50,000 and upward being taken, with duplicate subscriptions in many instances. A "team" of members of the machine-tool and allied trades, soliciting subscriptions, rolled up a handsome total of subscriptions, making its standing well toward the top of the various competing teams. The metal industries, in fact, may take considerable credit to themselves for the splendid showing made in Cincinnati for the second Government loan, which was not only subscribed up to the city's full allotment of $35,000,000, based on the maximum of $5,000,000,000 of bonds, but ran far ahead of that sum, the total reported from Cincinnati being well over $40,000,000. The city was the first of the larger class in the country to gain its maximum allotment.

Activity among the manufacturers and founders continues at a high rate. Not only is general commercial business entirely satisfactory, but the needs of the Government are taking more and more of the capacity of the local plants, either directly or indirectly. For example, Cincinnati machine-tool shops are given large credit for the success which attended the production of the much-discussed "Liberty motor" for aeroplanes; and when the manufacture of the motor on a large scale is begun, local plants will undoubtedly produce many of the brass and other parts which go into it. It is understood that the Lunkenheimer Company, for instance, widely known as a leading manufacturer of brass valves, has already handled large orders for valves for aeroplane engines, and it may be assumed that the company will do its share for the new motor.

In the United States District Court at Cincinnati an opinion has been handed down holding that the metal label patents of the Stanley Manufacturing Company are valid, and that they have been infringed in part by the Globe Metal Label Company. Other parts of the Stanley patents were not infringed by the Globe process, the court held.

The Salem Brass & Bronze Company, of Salem, Ohio, has been incorporated with a capital stock of $25,000, by C. J. Rath, J. M. Lytle and others.

D. W. Kerr, of Youngstown, O., president of the Ft. Smith Spelter Company, and associates have bought a rolling-mill plant at Greencastle, Ind., and will organize a $1,000,000 corporation to build a sheet-zinc mill. Raw material, in the shape of slab zinc, will come from the Ft. Smith, Ark., plant in which Mr. Kerr is interested. The project has been financed, and its completion is said to be fully assured.

The Electrical Metals & Manufacturing Company, of Youngstown, Ohio, has been organized by Frank P. Pyle, Paul S. Stam-

baugh and others, with a capital stock of $150,000. The company proposes to conduct a general metals business.—K. C. C.

DETROIT, MICH.

NOVEMBER 5, 1917.

The brass, copper and aluminum business reports but little change over that of a month ago, except, of course, that all are feeling more or less the effects of the war, such as high prices for raw material and scarcity of coal. Transportation facilities also are causing trouble. Taking conditions as a whole this line of business stands out best of any in the city. The munition manufacturers are busy of course, while the larger automobile plants, where great quantities of brass, copper and gray iron are used, report heavy orders and working to capacity.

The Ford Motor Company is employing about 45,000 men at present. Added to this Henry Ford, one day recently, subscribed $10,000,000 towards the Liberty Loan. While practically all manufacturing concerns in the city came through with large subscriptions the Ford interests did the best.

It is not believed manufacturers here will be compelled to curtail their output due to present conditions. The brass, copper and aluminum business never was in such a prosperous condition here. The war demand is largely responsible for present conditions.

The Michigan Stamping Company, at Mack avenue and the Outer Belt line railroad, is now operating in a large new plant. It is said it has orders ahead that will keep it busy for nearly a year. The company makes particular note of its new enameling department. Much automatic machinery has been installed that does away with hand labor.

The new Ford Tractor plant in Dearborn, Mich., a suburb of Detroit, is now well under way and is reported as about to begin manufacturing 6,000 tractors for England. Work also is being rushed on the plant on Warren avenue that will manufacture the new Liberty motor to be used in all Government aeroplanes. It also is reported that one local automobile company, the name not being given out, has started on filling an order for $40,000,000 worth of ambulances. Many of the auto parts and accessory corporations also are reported pressed with orders. All these concerns, it must be noted, are heavy consumers of brass and aluminum.

The Henseler Trolley & Manufacturing Company has recently let a contract for a one story brick and steel machine shop and foundry building at 378-80 Holden avenue. This company is now producing large numbers of copper trolley wheels.

The Barnes Foundry & Manufacturing Company is about to begin the erection of its first unit of the new plant in the River Rouge district of Detroit. The site is 600 feet wide and about one-half mile long. As soon as completed the plant will employ about 1,000 men. The company will manufacture castings for miscellaneous cylinders and pistons for aeroplane motors. Claire L. Barnes is president; George W. Smith, vice-president, and Charles E. Pelton, secretary and treasurer.—F. J. H.

TRENTON, N. J.

NOVEMBER 5, 1917.

Manufacturers in Trenton are feeling considerably the effects of the war upon labor and the situation has become serious at some of the metal industry plants. Skilled labor in some branches cannot be secured at any price and advertisements in newspapers and other periodicals fail to bring the desired help. It may become necessary to employ women at some of the lighter branches of the work. This proposition is being considered by one manufacturer, but he has not as yet placed any female help at work in his plant. When the government issued its first call for volunteers many responded and this was followed by the first selective draft. Many of the young men employed in the metal plants are single and naturally they could not be exempted when the call was issued. This resulted in badly crippling some of the plants of skilled labor.

Philip Billingham, president of the Billingham Brass and Machine Company, informed a representative of THE METAL INDUSTRY that conditions were very bad at his plant owing to the scarcity of skilled labor. "Some of my help is not very skilled," he said, "and this causes a great delay is getting the work out. In some cases it requires two and three men to turn out the work formerly done by one expert mechanic. Occasionally the employees fail to show up for work, and if we discharge any of them it would be impossible at this time to get help in their places. One day recently none of the help in the foundry showed up for work and that department had to close down for a time." Mr. Billingham said he believed that there would come a little slump some time and the men will be glad to work without losing any time.

The McFarland Foundry and Machine Company, manufacturers of brass, bronze and aluminum castings, is also feeling the scarcity of help and the need of expert mechanics. General Manager Frederick M. Staples said that work was often delayed and that it required more men to do the class of work formerly done by half the number. Camp Dix at Wrightstown, a few miles from Trenton, is taking all the extra help out of this city and there are now about 10,000 mechanics employed there at big wages.

The Trenton Brass and Machine Company is very busy and recently engaged a number of turret lathe hands, polishers and buffers. The selective draft also hit the J. L. Mott Company, Trenton Smelting and Refining Company, Skillman Hardware Manufacturing Company and the John A. Roebling's Sons Company.

The labor situation has also had some effect upon metal plants near this city. The Bordentown plant of the Standard Fuse Corporation has been abandoned and the machinery and stock removed to the works of the same corporation at Paulsboro, where government work will be carried on. The corporation has had plans drawn for a three-story factory at Paulsboro to cost $25,000 and will hereafter combine all its work at that works.

William M. Courtney, formerly employed as a molder, is now conducting a small brass foundry in the rear of his home, 343 William street, and is meeting with success. He has plenty of work, but finds it difficult to get the raw material. He is making a specialty of brass castings.

The Co-operative Safeguarding Company has opened a plant at 76-82 Lincoln avenue, where it is manufacturing brass safeguards. Walter H. Orr is the manager of the new concern.

There is such a demand for steel at the present time that phonograph needles are now being made of brass. Music stores are unable to buy any other than those made of brass, but these are more durable. It is reported here that the Government is considering the revision of the recently established Government copper price of twenty-three and a half cents a pound and allow an increase of at least $10 and possibly as much as $20 a ton for copper billets. The flat price of twenty-three and a half cents will remain the same for electrolytic copper. The war industries board imposed three conditions upon the copper producers: First, that there should be no reduction in wages. Second, that the operators would sell to the allies and to the public for the same price paid by the Government. And third that the operators pledge themselves to maintain a maximum production while the war lasts. The government wants plenty of copper produced and at the same time allow a fair price to the manufacturer.

The American Smelting and Refining Company will build a power plant addition at its plant at Perth Amboy. The new building will be 60 x 70 feet in size. The Union Smelting and Refining Company is building a large addition to its plant in St. Charles street, Newark, to cost $59,000.

Clayton R. Ricker, resident secretary of the New Jersey Zinc Company, has gone to Jacksonville, Fla., where he will have charge of the company's large timber resources there. He has been connected with the company for the past eighteen years. A reception was tendered him before he left and R. M. Catlin, superintendent of the company's interests in New Jersey, presented him with a gold watch, the gift of employes of the plant. About 1,500 employes of the Franklin and Ogdensburg plants attended the gathering.

The American Hardware Manufacturers' Association, in annual convention at Atlantic City recently, announced that prices are steadily raising and that shortly it will be a matter of extreme difficulty to obtain raw materials. About 1,200 delegates from all sections of the country attended the session. These included manufacturers and wholesale dealers and they pledged unanimously to co-operate with the Government. They also pledged to give themselves, their talents and their knowledge to the Government. It was pointed out that hardware was a necessity and that it would always be in big demand.—C. A. L.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The employes of the Doehler Die-Casting Company, Brooklyn, N. Y., have subscribed to the Second Liberty Loan to the extent of over $27,000.

The Strandwitz & Scott Company, manufacturers of sheet metal, is now occupying its new plant on South Second street, Camden. The new plant is double the size of the old one.

The Arth Brass and Aluminum Castings Company, Cleveland, Ohio, is planning to build a new 18 x 20 feet addition to its plant which will be used as a furnace room. The company operates a brass and bronze foundry and grinding room.

A two-story addition is being erected to the plant of A. H. Wirz, Inc., Third and Palmers streets, Chester, Pa. They operate a brass machine shop, tool and grinding room, casting shop, rolling mill, stamping, plating and lacquering departments.

The American Brass Products Company, Pottstown, Pa., has acquired the plant of the International Forge Company, which it will continue to operate. They operate a brass machine shop, tool room, brassing forging, stamping and tinning departments.

The City Brass Foundry, 5318 St. Clair avenue, Cleveland, Ohio, has awarded the contract for a one-story addition to its foundry at an estimated cost of $4,000. The company operates a brass, bronze and aluminum foundry and brass machine shop.

The Decorated Metal Manufacturing Company, 196 Degraw street, Brooklyn, N. Y., manufacturer of tin boxes and metal specialties, is planning the erection of a four-story addition. The company operates stamping, soldering, japanning and lacquering departments.

The Titan Metal Company, Bellefonte, Pa., is erecting additions to its plant to increase the capacity for the manufacture of bronze rods and kindred specialties. The construction includes a one-story addition, 60 x 200 feet, and two buildings, 50 x 150 feet and 35 x 135 feet, respectively.

James H. Rhodes & Company, Chicago and New York, recently purchased eight acres on the Hackensack River, just west of Jersey City, N. J., and are already proceeding with the erection of a dock and pumice mill, together with an extensive warehouse, which will cover about three acres of ground when completed.

The warehouses, offices and furnace room of the Capital Iron & Metal Company, Salt Lake City, Utah, are nearing completion. The furnace room will be used for the manufacture of babbitt metal, ingot copper, ingot brass, pig lead, spelter, solder, etc. The company will be in the market for crucibles, kettles and tumblers.

International Nickel Company, New York, reports for the six months to September 30, 1917, total income $7,776,277, as compared with $7,912,773; balance for dividends $4,751,774, as compared with $6,344,247, allowance having been made for war taxes this year; and surplus after dividends $1,974,320, as compared with $3,566,793.

The Fitzgerald Manufacturing Company, Meadow street, Winsted, Conn., manufacturer of sheet metal, is building a one-story, 100 x 140 feet, addition to its brass rolling mill. The following departments are operated by this company: tool room, grinding room, casting shop, rolling mill, stamping, soldering, polishing, plating, japanning and lacquering.

The Kramer Manufacturing Company, Carlstadt, N. J., has been incorporated with a capital of $100,000 to take over the E. Kramer Machine Company, manufacturers of hooks and eyes and other metal specialties. Edwin and Alfred Kramer are the incorporators. The company operates a tool room, stamping, tinning, plating, polishing and japanning departments.

The Western Brass Manufacturing Company, Chicago, Ill., has increased its capital to $200,000 and has acquired title to the property adjoining its present plant at the corner of Marshall boulevard and Twenty-third street. The company operates a brass, bronze and aluminum foundry, brass machine shop, tool and grinding room, and stamping, brazing, soldering, plating, polishing, japanning and lacquering departments.

The Cochrane Brass Foundry of York, Pa. is erecting a large addition to its plant. John H. Cochrane, president of the company, has closed another contract with the United States War Department for 200 tons of castings, to be used in the construction of submarines, gun mounts, aircraft guns and machine guns. The specifications require that two tons of the material be supplied daily until December 1 and four tons after that date until the order is completed.

The Twentieth Century Brass Works has purchased for $25,000 the assets of the M. H. Foundry & Manufacturing Company, Velleville, Ill., consisting of patents, patterns and the entire plant and equipment. The new company will continue the manufacture of sanitary drinking fountains, plumbing specialties and brass castings, in addition to conducting a general machine shop business. The company operates a brass and bronze foundry, brass machine shop, grinding room, plating, polishing and lacquering departments.

REMOVAL

E. E. Steiner & Co., builders of japanning, enameling and drying ovens of all descriptions, Newark, N. J., has moved from 58 Union street to its new plant at 117 New Jersey Railroad avenue.

CHANGE OF NAME

The American Bronze Company, Berwyn, Pa., manufacturers of bearing bronzes and operating a bronze foundry, bronze machine shop, tool and grinding rooms and casting shop, has changed its name to the American Bronze Corporation.

CORRECTION

Under the head "Printed Matter" in our October, 1917, issue mention was made regarding the Metric Reckoner, issued by Edward Le Bas & Co., and which gave the address of the company as 82 Beaver street, while the correct address is 64-68 Broad street, New York.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To Manufacture Rare Metal Alloys.—The Palau Metals Company, Los Angeles, Cal. Capital, $10,000. Incorporators: C. A. Overmeier, H. D. Mackinnon, William Kennedy and Edward F. Flynn.

To operate a plant for electro-galvanizing.—The Galvanizing Corporation of America, 244-252 Eagle street, Brooklyn, N. Y., has been incorporated with a capital of $36,000 to operate a plant for electro-galvanizing with the "Standard" process and for the manufacture of electro-galvanizing plants, machinery and solutions.

To manufacture brass and copper specialties.—The Keystone Brass Company, 486 Greenwich street, New York. Capital $10,000. Incorporators: S. L. Cohen, E. A. Alafberg and G. C. Norton. The company operates a brass and bronze foundry, brass machine shop, and polishing department.

TAKES OVER PROJECTILE PLANT

The Liberty Ordnance Company, New York, a newly organized corporation, capitalized at $4,500,000, of which Kenneth W. McNeil, of A. McNeil & Sons Company, coal merchant, 1 Broadway, New York, is president, has purchased the plant of the Bridgeport Projectile Company, Bridgeport, Conn. The company has received a Government contract for 12,000,000 shells and 300 naval guns. The plant of the Bridgeport Projectile Company is one of the finest of the newly built munition factories in this country. It was erected at the beginning of the war by German capitalists to provide war supplies for Germany. Upon its completion in April, 1915, it began work on a $5,000,000 contract received from the German Government for shrapnel cases. Through Carl Heynan, the Kaiser's representative, $2,000,000 was advanced to the company. Heynan severed his connection with the company when Count von Bernstorff was sent back to Germany. Present offices of the Bridgeport Projectile Company are at 52 Vanderbilt avenue, New York.

NEEDED FOR THE ARMY

The Quartermaster Enlisted Reserve Corps, with recruiting headquarters at 357 Broadway, New York, has received a new authorization to enlist men to follow their civilian trades in the army, for duty in this country and abroad.

The men particularly needed at this time include electricians, tinsmiths, iron workers, mechanics and blacksmiths. Enlistment is open to citizens of the United States, or to those men who have declared their intentions of becoming citizens. They must be between the ages of 18 and 45 years and have no one depending on them for support.

BRASS COMPANIES MERGE

The Connecticut Brass Corporation and the Pilling Brass Company, it is reported, have been merged into one concern to be known as the Connecticut Brass and Manufacturing Corporation. The new company will be capitalized with $600,000 8 per cent first preferred stock, $400,000 8 per cent second preferred, both $100 par value, and $2,000,000 common stock of $10 par. None of the first preferred is to be outstanding, according to the company's announcement, and will be held in reserve for the conversion of $600,000 two-year 6 per cent notes, which are to be issued.

The Connecticut Brass Corporation was formed last year by John E. Liggett, of Liggett & Drexel, to take over an industry which had been in operation at West Cheshire, Conn., for sixty years. The Pilling Brass Company has its plant at Waterbury. The plant at West Cheshire manufactures heavy coarse brass, while the plant at Waterbury is the largest manufacturer in the country of thin-rolled brass. The two companies have a combined smelting capacity of 2,500,000 pounds of finished brass.

Consolidated earnings for the year ended September 30 showed gross of $3,532,431, operating expenses of $2,963,016, and net earnings of $579,414.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Optical Pyrometers.—The Leeds and Northrup Company, Philadelphia, Pa., has issued Bulletin 860, which describes, both by means of photographs and text, the practical advantages and conditions for the use of the Leeds and Northrup optical pyrometer.

Speed Motors.—The General Electric Company, Schenectady, N. Y., has issued the October Bulletin No. 41,021, which forms one of the series that this company has been issuing for some time past and which is devoted to the illustration and description of type RF adjustable speed motors for use in furnishing power in industrial establishments.

Metals and Chemistry.—The MacMillan Company, New York, has issued a little seventy-eight-page catalogue descriptive of books on metallurgy and chemistry as published by them. The catalogue gives a brief description about the purpose and contents of each book that is listed. The sizes and prices of the various works are also mentioned. Copies of this catalogue may be had upon request.

Du Pont Products.—A handy little booklet containing a list of all of the products manufactured by them has just been issued by the E. I. du Pont de Nemours and Associated Companies. The booklet is small enough to fit in a busy man's pocket and will no doubt prove of interest as well as of value to many mercantile and industrial men. Copies will be sent upon application to the home office of the company at Wilmington, Del.

Brass.—The Brown's Copper and Brass Rollings Mills, Ltd., New Toronto, Ontario, Canada, has issued a card with the title of "Warning." The subject matter on this card relates to the danger existing for a consumer of brass and other metals to allow his supplies to run low. After citing several reasons for such danger the company announces that it is ready to furnish such metal as may be required and also guarantees entire satisfaction.

Polishing Machines.—The Smith, Richardson Company, Attleboro, Mass., has issued a new catalogue in the interest of their polishing, tubbing and drying-out machines. These machines represent different types now in general use among manufacturers of jewelry and other metal novelties of all kinds and descriptions. Steel balls, soap and water are the materials needed for operating these machines. The cost of the soap, which is the only thing used up in the burnishing process, amounts to between two and four cents per week.

Tumbling Barrels.—The Globe Machine and Stamping Company, Cleveland, Ohio, has published an attractive little booklet of thirty-six pages under the name of the Globe Tumbling Book. The book contains photographs and descriptions of the various types of tumbling barrels that this company manufactures, included among which are tilting and horizontal types and also a full description of a line of burnishing types of barrels for use with steel balls. Two pages of the book are devoted to a list of users of the various styles of Globe tumbling barrels. Copies of this booklet may be had upon request.

Turning Waste Into Profit is the title of a new book just issued by the Prest-O-Lite Company, Inc., of Indianapolis, Ind. It is devoted exclusively to the possibilities of reclaiming broken and worn machinery and metal parts for service by the oxy-acetylene process and is the most complete and comprehensive book ever issued on this subject. Containing eighty-two illustrations, it pictures and describes representative examples of reclamation welding work in practically every field of the industrial world. In the face of present high prices and scarcity of metal equipment, the subject of welding is receiving more than usual consideration, and this new book is truly a beacon to plant owners interested in the efficiency of holding down the scrap heap. It is mailed to any interested executive upon request.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

WRITTEN FOR THE METAL INDUSTRY BY W. T. PARTRIDGE.

COPPER.

November 5, 1917.

The Government price fixing of copper—at 23.50c. per pound—which it had been expected would immediately benefit all metal trades and copper particularly, really produced the opposite effect temporarily because of the many necessary adjustments to the new conditions that could not be quickly made. Business was practically at a standstill during the greater part of the month while information was being sought in regard to perplexing questions that remained unanswered. The price determined upon having been made between producers and the Government, dealers believed they were justified in selling spot copper at whatever price they could obtain for it and sales to consumers were reported at from 26c. to 30c. per pound, but even these sales were halted until the amount required by the United States Government and its Allies could be determined, which later was estimated to be 120,000,000 pounds for the last quarter 1917. This leaves 80,000,000 pounds per month for domestic consumers, an ample supply.

Exports of copper during 1917, to October 1, notwithstanding the small amount shipped in July, exceed those of any other nine months in the history of the industry and are within 10,000 tons of the maximum for twelve months in 1913.

TIN.

Delayed cables from London continued to interfere with business in tin during October. Shipping regulations retarded transactions in Straits metal, through the difficulties experienced in obtaining permits which require that the names of parties to whom tin is shipped be given. In consequence an acute situation was developed in spot metal here. It is believed, however, that eventually, through the efforts of the Tin Committee in conjunction with the United States Government and Great Britain, the various problems before them will be solved to the entire satisfaction of the trade here, which feels that it is being exploited by foreign traders. American tin statistics for September, published in October, were regarded as favorable and revealed shipments into consumption of 5,405 tons against 4,025 tons for the same month in 1916. Arrivals of tin at Atlantic ports in October were 2,060 tons with 4,300 tons reported afloat.

The month opened with spot Straits tin at 61c., a decline of ½c. from the September closing; spot Banca at 59.50c. and Chinese No. 1 55.75c. per pound. Fluctuations were within a range of 1½c. per pound until late in the month, when it became known that the withdrawal, until further notice, of all information concerning shipments of tin from the Far East had been officially announced by the Penang Chamber of Commerce on August 29, last. As business transactions are largely dependent upon such knowledge, consternation developed into demoralization of trade and prices advanced sensationally. At the close, spot Straits was held at 66c.; Banca tin at 64@64.50c.; Lamb & Flagg English, 99 per cent. metal, at 63c. and Chinese No. 1 was unobtainable at 63c. The net advance was therefore 5c. per pound on spot Straits and Banca and 8c. on Chinese No. 1.

LEAD.

The lead market in October was marked by great weakness, with three reductions made in the base price by the American Smelting & Refining Company which carried the official price from 8c. New York and 7.92½c. East St. Louis at the beginning of the month to 5.50c. New York and 5.42½ East St. Louis at the close. The independent producers met the first two reductions at once, with offerings at prices that cut under the "Trust" basis, which brought about a demoralization of trade. After the third reduction on October 24 improved business was at once apparent, consumers entering the market with inquiries that developed into very satisfactory transactions in spot and November metal. Dealers, too, were buying these positions. At the close the limits were 5.50@6c. New York and 5.42½@5.87½c. East St. Louis. Lead ore dropped from $90 to $60 maximum base.

SPELTER.

The spelter market during October was spasmodic and the trade was somewhat discouraged in the absence of business. Prices declined for prompt and October from 8.37½c. New York and 8.20c. East St. Louis at the beginning of the month, to 8.00c. New York and 7.62½c. St. Louis for prompt and November at the end of the month. December and first quarter positions at the close were fractionally higher. Zinc ore declined from $65-75 to $55-75 per ton.

ANTIMONY.

Immediately following the renewed activity in antimony during late September, dullness set in which soon affected prices, causing a decline from the opening at 15.12½@15.37½c. for prompt and October to 14@14.25c. for the same positions at the close, all duty paid. October shipment from the Orient also declined from 14c. in bond to 13c. by the end of the month.

ALUMINUM.

Prices of aluminum in October continued to recede under the influence of no demand and large supplies, registering a total decline of 4c. per lb. on the three varieties; from 40@42c. for No. 1 virgin 98-99 per cent. remelted to 36@38c.; from 38@40c. for pure 98-99 per cent. remelted to 34@36c.; from 30@32c. for No. 12 alloy remelted to 26@28c. per lb.

SILVER.

The rapid decline in silver noted during the closing week of September continued more slowly in October to the lowest point reached—82½c.—on the 25th; after which there was a sharp recovery to 90⅝c. followed by a decline to 90⅛c. by the last day. The net decline for the month was 5c. per ounce.

QUICKSILVER.

Prices of quicksilver in October declined $10 per ton to $100 by the 10th of the month, after which there was no change.

PLATINUM.

Platinum continued in steady demand throughout October with prices unchanged at $105 for pure and $111 for 10 per cent. iridium.

OLD METALS.

The old metals market during October was uncertain, unsettled and weak with the volume of business restricted because of the lack of speedy adjustment in the trade to the Government price-fixing of copper. The decline in prices, however, was not so severe as was anticipated and ranged from 1c. on the various coppers, brass and old zinc, to 2c. on solder joints, heavy lead, tin foil and block tin pipe, and to 6c. on old sheet aluminum. At the close of the month conditions were decidedly improved and a normal market was expected in the near future.

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper, 1916—Average for year, 28.77. 1917—January, 32.25. February, 35.25. March, 35.50. April, 32.75. May, 32.00. June, 32.50. July, 30.875. August, 39.00. September, 27.25. October, 27.00.

Brass Mill Spelter, 1916.—Average for year, 17.725. 1917—January, 13.05. February, 13.80. March, 13.45. April, 11.85. May, 11.05. June, 10.85. July, 10.55. August, 10.05. September, 9.80. October, 9.75.

OCTOBER MOVEMENTS IN METALS

COPPER:	Highest	Lowest	Average
Lake	....	No Market	......
Electrolytic	....	No Market	......
Casting	....	No Market	......
TIN	66.00	60.75	61.852
LEAD	8.00	5.50	6.983
SPELTER	8.37½	7.80	8.126
ANTIMONY	15.37½	14.00	14.659
ALUMINUM	41.00	36.00	38.591
QUICKSILVER (per flask)	$105.00	$100.00	$101.364
SILVER (cts. per oz.)	95⅛	82⅛	87,332

Metal Prices, November 5, 1917

NEW METALS.

	Price per lb.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Electrolytic, carload lots, nom.. } Government price	23½
Lake, carload lots, nominal.... }	
Casting, carload lots, nominal	23½
TIN—Duty Free.	
Straits of Malacca, carload lots	66.00
LEAD—Duty Pig, Bars and Old 25%; pipe and sheets. 20%. Pig lead, carload lots	5.5
SPELTER—Duty 15%.	
Brass Special	8.125
Prime Western, carload lots, nominal	7.80
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½ per lb.	
Small lots, f. o. b. factory	44.00
100-lb. f. o. b. factory	40.00
Ton lots, f. o. b. factory	36.00
ANTIMONY—Duty 10%.	
Cookson's, Hallet's or American	Nominal
Chinese, Japanese, Wah Chang WCC, brand spot..	14.25
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot or Ingots	50c.
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	Nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	$2.25
BISMUTH—Duty free	$3.00
CADMIUM—Duty free nominal	$1.475
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	$2.70
QUICKSILVER—Duty, 10% per flask of 75 pounds	$105.00
PLATINUM—Duty free, per ounce	$105.00
SILVER—Government assay—Duty free, per ounce	.90⅛
GOLD—Duty free, per ounce	$20.67

INGOT METALS.

		Price per lb.
Silicon Copper, 10%	according to quantity	49 to52
Silicon Copper, 20%	" "	55 to60
Silicon Copper, 30% guaranteed.	" "	60 to65
Phosphor Copper, guaranteed 15%	" "	60 to63
Phosphor Copper, guaranteed 10%	" "	59 to62
Manganese Copper, 30%, 2% Iron	" "	69 to75
Phosphor Tin, guaranteed 5%...	" "	82 to85
Phosphor Tin, no guarantee.....	" "	76 to81
Brass Ingot, Yellow	" "	18 to20
Brass Ingot, Red	" "	24 to26
Bronze Ingot	" "	24 to26
Parsons Manganese Bronze Ingots	" "	33½to35
Manganese Bronze Castings......	" "	48 to55
Manganese Bronze Ingots.......	" "	33 to35
Phosphor Bronze	" "	24 to30
Casting Aluminum Alloys.......	" "	42 to44

OLD METALS.

Dealers' Buying Prices.		Dealers' Selling Prices.
22.00	Heavy Cut Copper	23.50
22.00	Copper Wire	23.50
19.00	Light Copper	21.00
21.00	Heavy Mach. Comp.	23.50
14.50	Heavy Brass	16.50
11.00	Light Brass	13.00
15.00	No. 1 Yellow Brass Turning	16.50
18.00	No. 1 Comp. Turnings	21.00
7.00 to 8.50	Heavy Lead	7.50 to 9.00
6.00 to 6.25	Zinc Scrap	6.25 to 6.75
12.00 to 13.00	Scrap Aluminum Turnings	11.00 to 14.00
18.00 to 20.00	Scrap Aluminum, cast alloyed	20.00 to 22.00
26.00 to 28.00	Scrap Aluminum, sheet (new)	28.00 to 30.00
39.00 to 40.00	No. 1 Pewter	43.00 to 47.00
30.00 to 32.00	Old Nickel	34.00 to 36.00
23.00 to 25.00	Old Nickel anodes	26.00 to 27.00

PRICES OF SHEET COPPER.

Mill shipments (hot rolled) .... 35c. base net
From stock .... 37c. base net

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper .... 1c.

Metal Prices, November 5, 1917

PRICES ON BRASS MATERIAL—MILL SHIPMENTS

In effect October 30, 1917.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	\$0.31¼	\$0.34	\$0.36¾
Wire	.31¼	.34	.36¾
Rod	.29¼	.34¾	.37¾
Brazed tubing	.38½	——	.43¼
Open seam tubing	.38½	——	.43¼
Angles and channels	.38½	——	.43¼

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	\$0.33¼	\$0.36	\$0.38¾
Wire	.33¼	.36	.38¾
Rod	.31¼	.36¾	.39¾
Brazed tubing	.40½	——	.46¼
Open seam tubing	.40½	——	.46¼
Angles and channels	.40½	——	.46¼

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

29c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	41c.	per lb. base
100 lbs. to 300 lbs. in one order	42c.	" " "
Less than 100 lbs. in one order	43½c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛ ¼ ⅜ ½ ¾ 1 1¼ 1½ 2 2½ 3 3½ 4 4½ 5

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod	37½c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	34c.	" "
Muntz or Yellow Metal Rectangular sheets other than sheathing	37c.	" "
Muntz or Yellow Metal Rod	34c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 65c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES OF NICKEL ANODES.

85 to 87% purity	50c.	per lb.
90 to 92% "	55½c.	" "
95 to 97% "	55c.	" "

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

PRICE LIST SEAMLESS ALUMINUM TUBING.

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

PRICES OF SHEET ZINC.

Duty, sheet, 15%.	Cents per lb.
Carload lots, standard sizes and gauges, at mill	19 cent basis, less 8%
Casks, jobbers' prices	20c.
Open casks, jobbers' prices	20.5c.

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	45½c.	16%	50c.
8%	46½c.	18%	50½c.
10%	46¾c.	20%	52¼c.
12%	48½c.	25%	60c.
15%	49c.	30%	65½c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	47c.	15%	55c.
8%	49c.	16%	55½c.
10%	51c.	18%	57½c.
12%	53c.	30%	73c.

The above Base Prices are subject to additions for extras as per list printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more. 10c. over Pig Tin. 50 to 100 lbs. 14c. over, 25 to 50 lbs. 18c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 10c. over Pig Tin. 50 to 100 lbs. 12c. over, 25 to 50 lbs. 14c. over, less than 25 lbs. 20c. over

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from — below to — above the price of bullion.

Rolled silver anodes .999 fine are quoted at —— above the price of bullion. Manufacturers state that as silver is selling at a premium at the present time they are unable to give any quotation.

PRICES OF SOME METAL INDUSTRY CHEMICALS AND MATERIALS.

Phosphorus—Duty free, according to quality	Nominal.
Nickel Salts, Single bbl	14c. per lb.
Nickel Salts, Double bbl	11c. " "
Sodium Cyanide	37c. " "
Silver Nitrate, 100 oz. lots	54.75 per oz.
Sodium Carbonate (Sal Soda)	.05c. per lb.

PRICES FOR COTTON BUFFS.

Open buffs per 100 sections (nominal).

12 inch, 20 ply, 64/68, cloth	base	\$40.06
14 " 20 " 64/68, "	"	52.50
12 " 20 " 84/92, "	"	47.55
14 " 20 " 84/92, "	"	61.70

Sewed buffs per pound.

Bleached and unbleached	base	34c.
Colored	"	31c

PRICES FOR FELT WHEELS.

White Spanish—

Diameter.	Thickness.	Price.
6 to 10 inch	1 to 3 inch	\$2.60 per lb.
10 to 16 "	1 to 3 "	2.50 " "
6 to 16 "	Under 1 "	2.75 " "
Over 16 "	Over 3 "	2.60 " "

Mexican Wheels—

Diameter.	Thickness.	Price.
6 to 10 inch	1 to 3 inch	\$2.50 per lb.
10 to 16 "	1 to 3 "	2.40 " "
6 to 16 "	Under 1 "	2.65 " "
Over 16 "	Over 3 "	2.50 " "